73 Amateur Radio Today

JUNE 1994
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73 Reviews

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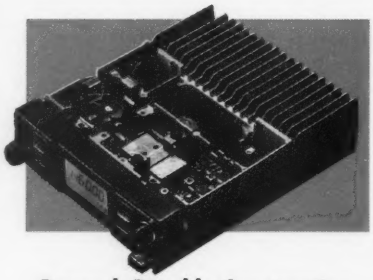

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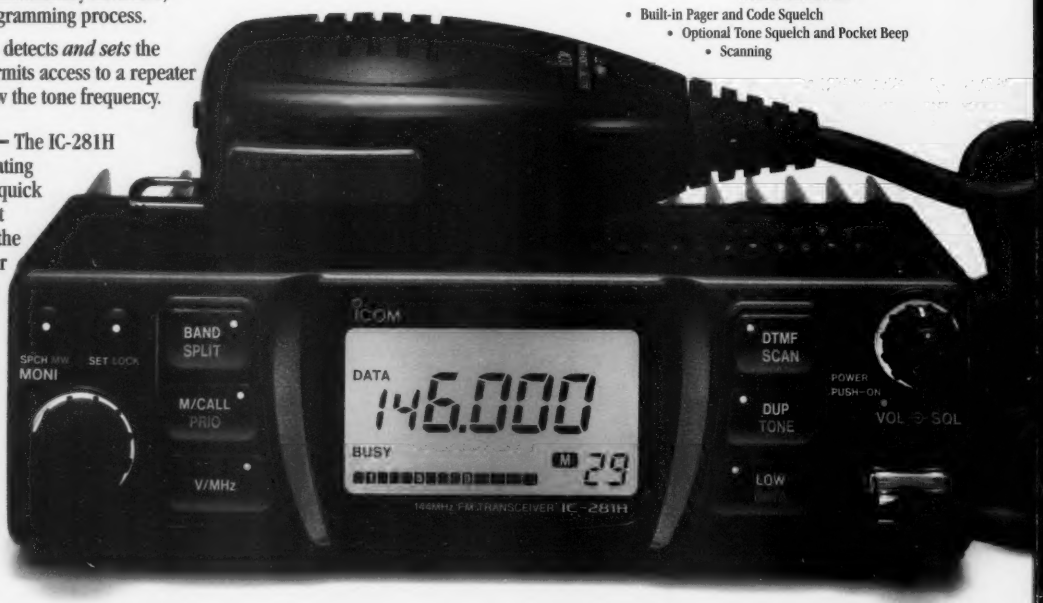

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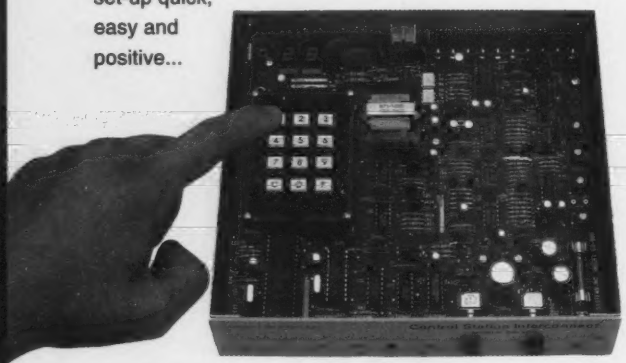

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CIRCLE 12 ON READER SERVICE CARD

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On the cover: Solar power can be easy and inexpensive if you know what you're doing. See page 10.
Photo by Donald Koehler N7MGT; solar cell photo by Mike Bryce WB8VGE.

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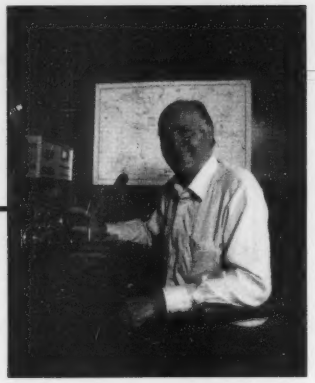

Reinventing Hamfests

Business has been busy re-engineering itself . . . coming to grips with the revolution in communications and computers. In 1980 almost 99% of all computing power was controlled by million-dollar mainframe and hundred-thousand-dollar minicomputers sitting in special temperature- and humidity-controlled rooms, and operated by white-smocked specialists. Today 99% of the computing power is handled by microcomputers sitting on desks.

Machines are numerically controlled by computers instead of skilled machinists. Middle-management layers have been eliminated. Our stores use bar codes at the checkout to calculate the bill, keep track of inventory, and reorder from the warehouse. Any business that doesn't make the best use of new technologies quickly finds itself irrelevant.

Even government is beginning to go through a time of re-engineering. The old layers of bureaucrats are gradually being replaced by computers and communications systems.

So what hasn't changed? I attended my first ham convention in 1938 and, other than the vintage of the equipment on display (the Hallicrafters Skyrider Diversity receiver was the big deal at the time), absolutely nothing has changed.

Oh, the big hamfests have gotten bigger and most of the small ones have disappeared. The exhibits are the same. The lectures are the same. The flea markets are the same. We only had around 40,000 hams in 1938, so the hamfests were smaller. But not as much smaller as you might think . . . because almost every ham in the area turned out for the hamfests in those days. Today, with over half our licensed hams completely inactive, and half of what's left only marginally active, many of the hamfests are about the same size as they were over 50 years ago. Today a hamfest is doing very well if it attracts 5-6% of the amateurs in the area.

Of course in those days we had CW and phone. Period. Well, yes, there were a few VHF pioneers way up there on 10 meters. The first ham I ever visited, Harry Stevenson W1CUN, was one of the 10m pioneers back in the mid-1930s. My grandfather took me to visit Harry's hamshack in 1934 and I was impressed. Very impressed. His "shack" was set up in a small storage building out behind the Valley View Inn in Bethlehem, NH, where his mother, Mamie, was the pastry chef.

My grandparents picked the town as a summer refuge from hay fever for my grandmother. They, and my mother, who was 20 at the time, spent their first summer at the Inn and got to be good friends with the owner, Johnny Macauley, and Mamie. They liked Bethlehem so much they bought an old farm with a cottage, where they spent their summers from then on.

It didn't take long before Sanger Green, from Littleton, the next town over, was dating my mother. That led to marriage and, eventually, me. And I spent my summers with my grandparents on the farm up until WWII.

When I saw the hamshack and watched Harry sitting there talking with hams all around New England, that was the first bite of the apple of wisdom. Wow! So I started playing with electricity and learning. I never would have guessed that in 1946, soon after I was discharged from the Navy, I'd have my own ham station set up in the same building that Harry used a few years earlier, sitting there working DX on 20m phone, and talking with hams all around the East Coast on 75m. Well, you see, the farm, as we called it, had no electricity. Heck, it had no water either, just a spring up on the hill with a pipe which my grandfather had put in, running into a big jar in the cellar. From there we pumped the spring water into the sink with a hand pump.

The toilet was a stinky backhouse out behind the barn and you got your feet wet in the dewy grass walking out there in the morning, and had to take along a flashlight at night. My first chore when I got up was to start the fire in the kitchen stove. Wood fire, using some newspaper, kindling, and a little kerosine. Then, when the water tank on the end of the stove was warm, I'd dip out about five gallons of warm water into a sprinkling can and hoist it with a rope for my morning shower. This was out in the woodshed, where it got cold at night, even in mid-summer. The shower water just ran through cracks in the floor boards and into the dirt under the shed.

We did have a telephone. It was a crank type and we were on a party line, ring three.

Lacking any electricity, I borrowed Harry's old shack to set up my ham gear during the summer of 1946. I'd just spent four years in the Navy and was going back to college in the fall, so sitting on a hillside in northern New Hampshire hamming seemed like a great way to spend my summer. I packed my Hallicrafters SX-28 receiver and my homemade pp 813 kilowatt all-band AM rig into my old 1939 Ford, drove it to Bethlehem, and was in business.

Hamfests 1994

With the recent apparent collapse of the much-touted *CQ* magazine commercial hamfests, which were, as usual, patterned on the 1930s style, and the winding down of interest in many other regular hamfests and conventions, perhaps it's almost time to consider what the hams of 1994 want, rather than what the hams of 1934 wanted.

In those days there was a small contingent on 160m phone, mostly using a 6L6 crystal oscillator modulated by another 6L6, and almost everyone else was on 40m CW. All the hams pretty much knew everyone else in their area, so meeting each other in person at a hamfest was fun. It was like a small fraternity.

As I've explained, the steadily increasing exhibit costs at Dayton forced the *73* staff to rethink their policy of exhibiting, which I first started in 1955, when I became the editor of *CQ*. Many industry people have been taking a closer look at the rising costs of booth space and the sales resulting from hamfest exhibiting . . . and staying away. They've found there are far less costly ways to generate sales.

The parking situation at Dayton is horrendous, with long walks for almost everyone. Then, when it rains, you can be in mud up to here. And it has tended to rain. The thousands of cars fill the open fields around the Arena, making an impressive picture from the air. But I sure wish they'd come up with a better location for their hamfest.

One of the reasons Dayton draws such a big crowd is that it's centrally located in the country and provides a practical way for hams with special interests to get together. The weather satellite picture hams meet. The ATVers meet. The slow-scanners meet. And so on.

So why not take advantage of this and refocus hamfests as platforms for interesting newcomers in these ham special interests? The slow-scan group could be encouraged to set up exhibits demonstrating what they are doing and how to get started. They could put together some videos to help their exhibits. All the other ham special interests could be represented by the ham industry companies supporting their interest, plus any clubs and outstanding hams involved with that interest.

Would you like to see all the packet groups together, complete with videos and demonstrations? Ditto the ATVers, complete with videos of their balloon video trips. And so on down the list of sub-hobbies which go to make up amateur radio.

What's new in RTTY? In high-speed CW? In 10 GHz pioneering? In AMTOR? In Clover? In QRP? How about certificate hunting? Any chance of code-copying contests with certificates of merit for different speeds? Transmitter hunting gear? 160m DXing? 75m phone DXing?

Could we start using hamfests as a way to attract newcomers? If we invited interested school kids to come, and we had exhibits which explained how repeaters work, ham satellites, and so on, we might start seeing some interest from youngsters.

Judging from the downhill slide of interest in hamfests, either the organizers are going to have to reinvent them or bury them. After over 60 years of the same old stuff, it's beginning to smell.

What Would Get You to Come?

My AIDS cure editorial generated one of the biggest stacks of reader mail in years. I enjoyed that, but it isn't enough. Now I want to get you to thinking creatively about hamfests. Yes, I know, you've been through the same 16 years of our American mind-numbing school system I suffered, so you've been punished for most of those years every time you attempted to think or ask questions. It's time to start breaking this pattern and getting what little is left of your atrophied gray matter into gear.

Let me know what ideas you have for hamfests. What could they do that would get you to drive a hundred miles and maybe stay for a day or two?

Think about it. Talk at your ham club meetings. Discuss it on the air. Let's have some ideas on how hamfest organizers can make sure that you'll drive at least a hundred miles to get to the next hamfest in your area. What would it take?

Customer Unservice . . .

One of the lessons successful companies are learning is the importance of customer service. And it's 10 times more important in the ham field, where so many customers are on the air and talking with prospective customers. The

Continued on page 76

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Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 3.5dBi ½ wave 446MHz 6.0dBi ⅝ wave x 2	1.5:1 or less	150 watts	3' 5"	Gold Plated PL-259

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SB-7/SB-7NMO Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

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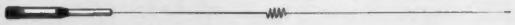


NEW!

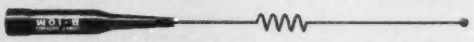
SB-5/SB-5NMO Dual-Band 146/446MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 3.0dBi ½ wave 446MHz 5.5dBi ⅝ wave x 2	1.5:1 or less	120W FM	38"	PL-259 or NMO style

NEW!

SB-2/SB-2NMO Dual-Band 146/446MHz

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi ¼ wave 446MHz 3.8dBi ⅝ wave	1.5:1 or less	60W FM	18"	PL-259 or NMO style



NEW!

B-10/B-10NMO Dual-Band 146/446MHz, Cellular Look-a-like

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 0dBi ¼ wave 446MHz 2.15dBi ½ wave	1.5:1 or less	50W FM	12"	PL-259 or NMO style

B-20/B-20NMO Dual-Band 146/446MHz, Cellular Appearance, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi ½ wave 446MHz 5.0dBi ⅝ wave x2	1.5:1 or less	50 watts	30"	PL-259 or NMO style

NEW!

SB-25/SB-25NMO Mono-Band 146MHz w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 4.1dBi ⅝ wave center loaded	1.5:1 or less	100W FM	4' 9"	PL-259 or NMO style

NEW!

COMET products are available from most major dealers. For customer service, or a complete catalog, please call us at 800/962-2611. We're confident COMET products and accessories will enable you to enjoy Amateur Radio to its fullest!

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MINI SPEAKER/MIC

HM-P2K/F
Mini spkr/mic featuring full TX/RX quality!

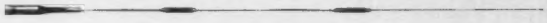
Light weight, extremely small: 1"x2" with collar pocket clip.

HM-P2K: Kenwood Version
HM-P2F: Icom/Yaesu Standard/Alinco/etc.

TRI-BAND MOBILE ANTENNAS

CX-224/224NMO Tri-Band 146/220/446MHz, w/Fold-Over, No Ground Plane Required

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
146MHz 2.15dBi ½ wave 220MHz 3.6dBi ⅝ wave 446MHz 6.0dBi ⅝ wave x 2	1.5:1 or less	100 watts	3'	PL-259 or NMO style



FJ-15S Tri-Band 52/146/446MHz w/Fold-Over

Gain & Wave:	VSWR:	Max Power:	Length:	Connector:
52MHz 2.15dBi ¼ wave 146MHz 4.5dBi ⅝ wave 446MHz 7.2dBi ⅝ wave x 3	1.5:1 or less	120 W FM	4' 10"	PL-259

HF MOBILE AND HT ANTENNAS

HA-4S Quad-Band HF 40/*(20)/15/12/10 Meters w/Fold-Over

Wave:	VSWR:	Weight:	Length:	Max Power:	Connector:
¼ wave	2:1 or less	1 lb. 14 oz.	4' 4"	120W SSB (200W SSB 28MHz)	PL-259

*L-14HS Optional 20 Meter Coil

NEW!

SH-55 Super Flexible 146/446MHz HT Antenna

Gain & Wave:	Max Power:	Length:	Connector:
146MHz 1.5dBi ¼ wave 446MHz 3.2dBi ⅝ wave x 2	10 watts	15.5"	BNC

CH-722SA High Gain HT Antenna
Gain & Wave: 146MHz 3.0dBi ½ wave
446MHz 5.5dBi ⅝ wave x 2
Max Power: 50 watts
Length: 35", 2 sections, 18" each
Connector: BNC

NEW!

CH-32 Miracle Baby
146/446MHz HT Antenna
Gain & Wave: 0dB ¼ wave
Max Power: 10 watts
Length: 1.75"
Connector: BNC

DUPLEXERS AND MOBILE MOUNTS

CF-4106K, I, J, 146/446MHz

Band Pass, Ins Loss, Max Pwr.
1.3-150MHz, 0.1dB, 800w PEP
400-540MHz, 0.2dB, 500w PEP
Isolation: 60dB
CONNECTORS:

	4160K	4160I	4160J
Output:	SO-239	SO-239	SO-239
Low In:	PL-259	PL-259	SO-239
High In:	PL-259	N-Male	SO-239

RS-21
Trunk, hatchback, rear door (van, blazer, etc.) mount. Adjustable to virtually ANY angle. Rubber-coated base protects vehicle paint.

NEW!

RS-820
Heavy-Duty, Low Profile Trunk Lip or Hatch Back Mount. Rubber-coated base protects vehicle paint.

WS-1M
Multi-Adjustable Window Clip Mount
11.5 feet of high quality coax. Gold-plated UHF Conns. for Antennas up to 40" in height.

NEW!

3D4M Standard Cable Assembly
13.5 feet of low loss coax. Gold plated UHF (PL-259/SO-239) connectors.

3D5M Standard Cable Assembly
Same as 3D4M, but 17 feet of coax

CK-5M Deluxe Cable Assembly
13 feet double shielded very low loss coax + 12" RG-188 teflon coax. Gold plated UHF (PL-259/SO-239) connectors.

CK-5M5 Deluxe Cable Assembly
Same as CK-5M, but 17 feet of coax

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Steve Katz WB2WIK/6, Chatsworth CA I am truly grateful for the wonderful response to my 2 meter amplifier conversion article in the April 1994 issue of *73*. It restores my faith that not all hams are appliance operators and some are still willing to tackle worthy home-brew projects other than simple digital circuits. Within three weeks after publication of this article, I received 89 letters, faxes or cards from fellow amateurs sincerely interested in following the instructions to completion of their own home-brew half-kilowatt VHF amplifier. I've tried to answer every single inquiry as thoroughly as possible, to assist those in need of help to actually complete their projects and get them on the air. Bravo to our readers and fellow home-brew and VHF-UHF weak-signal enthusiasts! Get those amplifiers running and look for me on the "weak signal" modes.

Marcus Ely KB7UIS, Fort Worth TX Thank you for including plans for home-brew radios and equipment in your periodical. I have successfully (finally) built the SP-1 Spider transceiver designed by Mike Agsten WA8TXT, featured in the January 1993 issue. I built it from scratch, in the 30 meter and the 40 meter versions. I am new at home-brewing, but I had a ball, as I learned very much in making these radios. I even etched my own circuit boards.

Mr. Agsten has been very helpful. He has patiently answered my questions by mail. I had some problems, mostly due to my own soldering, or to incompletely etched traces on my home-brew boards. But, each time I wrote to Mr. Agsten he steered me to the part of the board or the component to check, and I found the problem.

Randy Minnick WA6IXI, Longview WA Wayne, I simply *had* to write to say "thanks" for helping me to get off my dead . . . er . . . uh-huh . . . and move towards an upgrade after being a ham for 20 years.

If it weren't for your carping about such matters, I doubt very seriously if I would have given all that much thought to the matter, what with being quite comfortable with my ticket (Advanced) and all. (After all, what are a few extra kHz privileges, anyway?) The fact of the matter was that you were right. I simply had no excuse not to. You actually caused me to choose to be honest with myself or stay in "limbo land" with no direction and "no one at the helm."

Not only have I successfully upgraded to Extra, but my packet station is almost complete now and, though I've been a dedicated HFer for 20 years, I'm now having a great time on VHF. My soldering iron is going to get hot again as I start building QRP equipment after too long a time. There is also a new business opportunity that I'm pursuing that will allow (among other things) a new HF rig.

Having been a reader of *73* since early '73, it was obvious that you are a very rare individual who sees things quite clearly and then, after assessing a situation, does whatever is required to "get the job done." I further saw that you saw *no real reasons* for others to not live up to their fullest potential, not accepting their lame, and usually invalid, excuses.

But what really impressed me was that you strove, and are striving, to motivate others so that they might overcome "themselves" and their self-limiting thinking. There is/was no real "carping," but genuine wit and (really) good-natured bantering proffered, not for destructive and self-righteous criticism, but for the *motivation* that *we*, the too-silent majority of "HAMsters," might start the thinking (and dreaming) that is *required* to overcome the natural inertia that quietly begins to creep upon us as we age and lose the fire and wanderlust that burned so brightly in our breasts as youths (who were *not* afraid, incidentally, to experiment and innovate). I noticed the tidbits that you tossed out to stimulate our thinking and, per adventure, blow off some of the cobwebs we've allowed to collect between our ears ("use it or lose it" *is* a universal law); tidbits that would benefit not only the hobby but the economy (especially the personal economy).

I also have seen your detractors, to which, again, I say "thanks," Wayne, for not giving in to them and letting them steal your dreams and rob you of your gusto for life so that you might continue to positively influence others. Even if no one else has been affected, I have been.

David Mallory N4VW, Spartanburg SC Wayne, I thought you'd appreciate knowing that I just finished a "supper" of beans, corn bread and milk, and I will repeat that for three more meals because of your intelligent technical sarcasm! No $5 meals out at the diner.

You see, I am an electrical designer (CAD) who is unemployed due to a fifth downsizing. But, the renewal notice you wrote is so right-on-target that I'll gladly sacrifice food for the stomach for the food for the mind that your magazine continues to provide. Your insight is refreshing, yet realistic about our tough technical world. Only the "whiners" miss the true intent of your sarcasm. *You love* this hobby and the people and industries that also love it and feed its growth! You are the catalyst for the "What if?" and "Why not?" thinkers. So OK, you got my renewal price again, but I thank you.

Trevor Davis VE3DKV, Kirkland Lake, Ontario, Canada Wayne, I have a proposal to make and that is to allow all amateurs to operate HF, but only at QRP unless they have Morse code, then they can fully use the TX power that their privileges allow them to use. Amateurs with an Advanced ticket, or whatever is equivalent in the US, should be allowed to use a maximum power of, say 100 watts AM, unless they have their Morse code ticket. I believe this would greatly help in promoting the amateur radio hobby and maybe, with the 10 meter band busy, we can scare off the bootleggers of the band.

Trevor—I've proposed something much like this, but got little reader response. The Japanese do this, limiting no-coders to 10W on all bands . . . Wayne

Allan Feir VE6CGP, Calgary, Alberta, Canada After reading your rantings and ravings for some time, I finally did it. I took out a subscription to *73* so I wouldn't miss any of your editorials. While I don't agree with everything you say, I do agree with most of it, and I find your topics to be very timely.

If you are concerned about lousy government, take notice of what we do in Canada: We turf them and leave their party in shambles. Next, maybe we will think ahead and have a decent alternative ready to be voted in. That, of course, is where we all need to get off our butts and do something.

Philip D. Wilbur N5STW, Dallas TX Wayne, I started reading *73* about a year ago on a regular basis. I don't always agree with everything you say in your editorials, but then who should? At least you make me think about different aspects of a subject.

In response to your February issue, I have checked out a copy of *Cross Currents* and have started reading it. I have also shown your editorial to people at work and at least one individual is planning to purchase the book. I would like to see the design of the two experimental devices for chasing and killing the HIV virus.

My interest is not specifically with AIDS but with viruses in general, especially in the parrot family. Since conventional medical treatment for most viruses is next to nonexistent, other than to treat the symptoms and hope the patient outlives the disease, it is refreshing to find other possible alternatives.

Concerning your March editorial, the information on light hits a little closer to home. My father grew up in Arizona on a farm in the early part of the century. He was exposed to much sunlight for many years. He was also a commercial and military pilot for 40 years. For the last 35 or so years he has fought skin cancer. I have also shown signs of skin damage, but at an older age than when my father's first appeared. I have not chased down Lieberman's book. It will be interesting to see how he explains an alternative to conventional theory about the dangers of ultraviolet radiation. Just as there is evidence to show that hams tend to die at a younger age, there is also evidence to show that people who have spent a lot of time looking at the daytime sky, such as radio control airplane fliers like myself, have more eye problems than the general populace. I don't know if he addresses this issue—it could have drastic consequences if not approached very carefully.

Philip—The closer we live to the conditions in which our species developed, the healthier we should be. Too much of almost anything seems toxic, so perhaps it's that way with light. Ditto too little. We need certain vitamins, but in the quantities our species has adjusted to. We need . . . not too much and not too little.

There are other factors that are beginning to come to light. You've read about the 50% drop in sperm count over the last 50 years, possibly resulting from pesticide pollution. Well, whatever is doing that isn't leaving the other 50% of our sperm in good shape. And what's it doing to the ova? and to other aspects of our bodies, as well as to our children?

We know that nicotine, alcohol and other drugs adversely affect sperm and ova, and we know the effect sure isn't positive. Now we're finding that EMFs also affect sperm, as do magnetic fields, and even gravity. What a mess! Try mating some mice over a positive magnetic terminal, and others over a negative terminal. Try this with seeds! With one polarity you get big, fat, happy dumb mice. With the other you get thin, smaller, smarter mice.

Now, on cancer, perhaps you'll learn more about this if you read Douglass' book, Into The Light, *184ff. Interesting. Cheers . . . Wayne*

Tom Cox KA5NEE, Muncie IN Wayne, thanks for your recommendation of the book *Cross Currents* by Dr. Robert Becker. I was skeptical about the credibility of this book before I read it, but no more. I am a respiratory therapist, a free-lance writer, and a radio amateur, and that combination of viewpoints increased my appreciation of Dr. Becker's expertise and his writing ability.

I was impressed with the weight of scientific data that shows the impact that even very weak EM fields can have on the body. I have never seen this data cited in the mainstream media, which is odd, considering their penchant for lending free publicity to environmental causes that have no scientific basis, such as the greenhouse effect and ozone depletion.

The potential for therapeutic uses of DC and AC fields is truly exciting. Traditional medicine certainly leaves a lot to be desired in the treatment of cancers and chronic lung disease. Any potential advance in these areas needs to be investigated, and any politically-motivated resistance to this research from the government or the scientific establishment is irresponsible.

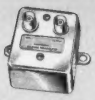
You mentioned in your editorial that this field is wide open for experimentation by radio amateurs. I hope to see some articles about this topic in future issues, but I can imagine that you'll have some serious legal concerns to work out before any "how-to" or experimental articles can be published. One project I'm anxious to see is a reasonably-priced ELF field-strength meter. Surely that could be done without making any illegal health benefit claims or product liability exposure. I would like to have the means to evaluate the fields in my own environment, as well as the effectiveness of any protective measures I may take. Didn't some reviews of commercially-available ELF field-strength meters appear in *73*? As I recall, they were either expensive or unreliable, or both. Surely we can do better.

Keep poking your stick into the hornets' nest, Wayne. My next purchase is *Light, Medicine of the Future.*

Tom—Watch for the AcuGauss unit! . . .Wayne 73

Low Cost GaAsFET PREAMPS

LNG-(*)



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FEATURES:
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- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-152, 152-172, 210-230, 400-470, 800-960 MHz.*

LNW-(*) MINIATURE PREAMP

ONLY $29 kit, **$44** wired&tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

ONLY **$89** kit, **$119** wired&tested

- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Tuning range: 120-175, 200-240, or 400-500.*

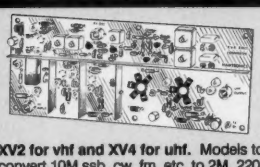
HELICAL RESONATOR PREAMPS

- GaAs FET preamps with 3 or 4 section helical resonators **reduce intermod & cross-band interference** in critical applications. **MODEL HRG-(*), $80 vhf, $110 uhf.** **Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS

Low noise converters to receive vhf and uhf bands on a 10M receiver.
- **Kit less case *$49*, kit w/case & BNC jacks *$74*, w&t in case *$99*.**
- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (to chan 3).

TRANSMITTING CONVERTERS



XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 220, 222, 432, 435, and atv. 1W output. ***Kit only $89.*** PA's up to 45W available.

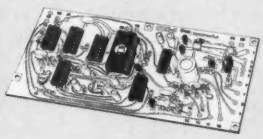
ACCESSORIES

Versatile DVR-1 DIGITAL VOICE RECORDER Module. As a **voice ID'er for repeaters**, records your voice, using the built-in microphone or external mic. Use with almost any repeater COR module. May also be used as a **contest caller** to play back one or more messages through your transmitter at the press of a switch. Used as a **radio notepad**, it can record the audio output of a receiver — up to 20 sec. of anything you might want to recall later. Play back as many times as you like through a small external speaker. Extensive manual tells how to use multiple messages and adapt for many applications. .....kit $59, w&t $99

TD-4 SELECTIVE CALLING Module. Versatile dtmf controller with 1 latching output. Mutes speaker until someone calls by sending your 4-digit tt code. Or use it with a long tt zero digit to alert anyone in club. Also may be used to control autopatch or other device. .....kit $49, w&t $79

COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier. .....kit $39

CWID. Diode programmable any time in the field, adjustable tone, speed, and timer. .....kit $59



COR-4. Complete **COR and CWID** all on one board. CMOS logic for low power consumption. EPROM programmed; specify call. .....kit $79, w&t $129

NEW **COR-6, COR & Real-Voice ID** on one board. Digital ic records up to 20 seconds of your voice, using built-in or ext. mic. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter. .....kit $99, w&t $149

TD-2 DTMF DECODER/CONTROLLER. 16 digits, toll-call restrictor, programmable. Can turn 5 functions on/off. .....kit $79, wired & tested $139

AP-3 AUTOPATCH. Use with above for repeater autopatch. Reverse patch and phone line remote control are std. .....kit $79, wired & tested $139

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver ..... kit $39

TD-3 SUBAUDIBLE TONE DECODER/ENCODER. Adjustable for any tone. **Especially for repeaters,** with remote control activate/deactivate provisions ....kit $29, wired & tested $59

MO-202 FSK DATA MODULATOR & DE-202 FSK DEMODULATOR. Run up to 1200 baud digital signals through any fm transmitter & receiver with full handshakes. Radio-link computers, telemetry, etc. .... kit ea $39, w&t ea $69

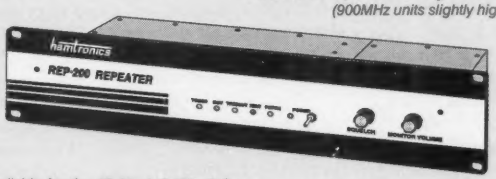
9600 BAUD DIGITAL RF LINKS. **Low-cost** packet networking system, consisting of MO-96 Modem and special versions of our 144, 220, or 450MHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

REP-200 REPEATER

A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

We don't skimp on rf modules, either! Check the features on R144 Receiver below, for instance: GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

Kit $1095; w&t only $1295!
(900MHz units slightly higher)



- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service (150 & 450).
- Power out 20W 50-54MHz; 25W 143-174MHz; 15W 213-233 MHz; 10W uhf; 10W 902-928MHz.
- Available add-on PA's **up to 100W.**
- **Six courtesy beep types,** including two pleasant multi-tone bursts.
- **Open or closed access autopatch, toll-call restrict,** auto-disconnect.
- **Reverse Autopatch,** two types.
- **DTMF CONTROL:** over 45 functions can be controlled by 4-digit dtmf command, via radio or telephone.
- **Owner can inhibit** autopatch or repeater, enable either open or closed access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr.
- Cw speed and tone, beep delay, tail timer, and courtesy beep type **can be changed at any time** by owner password protected dtmf commands.
- **Auxiliary receiver input** for control or **cross linking repeaters.**
- Color coded **LED's indicate status** of all major functions.
- 3½ inch aluminum rack panel, finished in eggshell white and black.

NEW **REP-200T Voice Message Repeater.** As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air** and played back at user request by DTMF command, or as a periodical voice id, or both. ..... **kit $1145, w&t only $1395**

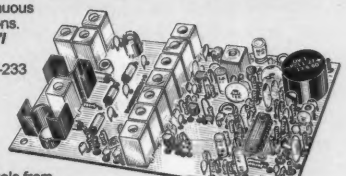
NEW **REP-200C Economy Repeater.** Like REP-200, except uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice id** recorded with built-in microphone. ..... **Kit only $795, w&t $1095**

REP-200N Repeater. Want to use your ACC controller, etc.? No problem! We'll make you a repeater with rf modules only. ..... **Kit only $695, w&t $995**

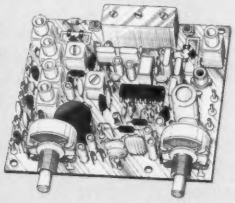
XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-tight enclosures, and with data modems.

FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. ***FCC type accepted for com'l high band & uhf.***
- **TA51**: 50-54, 143-174, 213-233 MHz ...kit $109, w&t $189.
- **TA451**: 420-475 MHz ...kit $109, w&t $189.
- **TA901**: 902-928 MHz, (0.5W out); w&t $219.
- **VHF & UHF AMPLIFIERS.**
- For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at $99.



FM RECEIVERS:
- **R144/R220 FM RECEIVERS** for 143-174 or 213-233 MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift. ...kit $149, w&t $219.
- **R451 FM RCVR,** for 420-475 MHz. Similar to above. ...kit $149, w&t $219.
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion, GaAs FET front end. ...$169, w&t $249.
- **R76 ECONOMY FM RCVR** for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res or afc. ...Kits $129, w&t $219.
- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Kit $129, w&t $219.



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QRX . . .

Cold Fusion is Hot

If you aren't finding enough challenges in ham radio, perhaps you'd like to dabble in a growing technology that could very well make you rich. The water-fuel phenomenon called *Cold Fusion* has prompted Publisher Wayne Green to launch a full-color glossy magazine bearing that name to help springboard research. The 96-page premier issue hit the newsstands in May.

You may remember news reports of the cold fusion breakthrough when its discovery was announced at the University of Utah by Drs. Martin Fleischmann and Stanley Pons back in 1989. While many in the so-called research "establishment" have spurned the idea, *Cold Fusion*'s Editor, Eugene Mallove, Sc.D., says the technology is "far from dead."

"Cold fusion releases enormous quantities of energy in the form of heat, not radiation, as in hot fusion. This heat energy is hundreds to thousands of times what ordinary chemical reactions could possibly yield," says Mallove, who was nominated for a Pulitzer for his book *Fire from Ice*. "If cold fusion is a heretofore unknown form of benign nuclear reaction—as most researchers in the cold fusion field believe—there is more potential cold fusion energy in a cubic mile of sea water than in all of the oil reserves on earth." A subscription to *Cold Fusion* costs $98 USA; phone (800) 234-8458; FAX (603) 924-8613. *TNX* Cold Fusion *magazine.*

Call for Papers

A call for papers has been announced for the 13th ARRL Conference on Digital Communications. Suggested topic areas include: data communications, computer networking via radio, protocols, packet-radio hardware and software, applications, authentication techniques, digital voice communications, speech compression, multiplexed systems, digital image communications, radio propagation effects, application of new technology to amateur digital communications, digital signal processing, spread spectrum, and state-of-the-art microelectronics.

The '94 Digital Communications Conference will be held in Minneapolis (Bloomington, MN) on August 19-21. Deadline for receipt of camera-ready papers is June 20, 1994. Papers should be sent to Maty Weinburg, ARRL, 225 Main street, Newington, CT 06111; (203) 666-1541, or Internet lweinber@arrl.org. *TNX ARRL*

Massive Global Internet Announced

Two of the richest men in the nation, Microsoft's Bill Gates and McCaw Cellular's Craig McCaw, are pooling their dollars in a $9 billion project to blanket the earth with more than 900 satellites capable of high-bandwidth communications. Separately, Microsoft has invested in a terrestrial radio E-mail network for portable communications devices.

The project was actually invented last year by Edward F. Tuck WD6CRP under the corporate identity of Calling Communications—a name which generated little publicity. That is, until Gates and McCaw recently invested heavily and renamed the venture Teledesic Corp. Tuck is Vice Chairman of the new company.

The FCC application was accompanyed by the obligatory $216,000 application fee. Teledesic expects to offer voice channels, broadband videoconferencing and interactive multimedia channels, along with realtime two-way data services on 880 active plus 84 backup birds. If devoted to voice exclusively, the system could support 20 million users! It will, however, be used to support a smaller number of channels with a higher average bandwidth. *TNX W5YI Report, Issue #8, April 15, 1994.*

Ham to Head PCS Task Force

The FCC's task force on emerging personal communications service (PCS) issues will be directed by Private Radio Bureau Chief Ralph Haller N4RH. Besides serving as a "focal point" for all PCS matters, the new task force will aim to ensure continuity among all of the commission's bureaus and policies.

FCC Chairman Reed Hundt said, "I am confident that under the leadership of Ralph Haller, the PCS task force will lead the commission in the timely development of a comprehensive regulatory framework for PCS."

But, development may not be so timely, according to the *Washington Post.* The newspaper has reported that the development of the PCS service may be delayed at least another year. At last count, 66 Petitions for Reconsideration have been received at the FCC in the wake of last September's adoption of a PCS spectrum plan. The complex plan calls for auctioning off a huge chunk of radio spectrum. *TNX Westlink Report, No. 669, March 31, 1994.*

DBS Service Up and Running

DirecTV—a division of Hughes Aircraft Corp.—has begun sending more than 20 television channels directly to several hundred American homes via satellite. This is the first step in what company officials believe will be a nationwide DBS (direct broadcast satellite) service by the end of the year.

The company recently unveiled its new headquarters in Castle Rock, Colorado, the site of its four 13 meter uplinks. DirecTV plans to add a second geostationary satellite at 17 GHz, operating at what one company official described as a higher frequency than any other FCC-defined service.

Customers will use set-top boxes equipped with RS-232 ports for direct PC or workstation connections and also link directly to telephone lines for billing. The system will support a variety of broadband interactive services. *TNX Electronic Engineering Times, Issue 791, April 4, 1994.*

QRP RFI Calling . . .

The Federal Communications Commission has released the results of a recent study on telephone RFI (radio frequency interference), and the results suggest that transmitter power was not a significant factor in these cases. The telephone interference research was conducted by 35 FCC field offices, each one visiting the scene of three randomly-selected cases. The transmitting stations included 47 citizen's band, 27 amateur, 23 AM broadcast, 10 FM broadcast, and one international broadcast station.

At each location, government investigators tested the telephones in question, FCC "bulletproof" telephones, and a variety of filters. In one-third of the cases, 10 watts or less caused the RFI. Filters were successful in eliminating the interference roughly one third of the time.

The FCC also said, "Manufacturers can design telephones to be interference free." The commission's "bulletproof" phones were immune from the RFI "virtually all of the time." The survey is intended to help the parties "to productively address and resolve this problem." *TNX Westlink Report, No. 669, March 31, 1994.*

Japan Accelerates Information Highway

The country with more ham operators per square mile than you can shake an HT at is revving up plans to build a high-tech information highway. The Tokyo metropolitan government and the Ministry of Posts and Telecommunications is expected to announce a fiber-based multimedia telcom network that will carry interactive cable TV and on-demand video games starting in 1996.

The project is part of a grand national plan to bring fiberoptic telecommunications to virtually all Japanese homes by 2010. Several American and other non-Japanese companies are showing interest in the project, according to a Ministry official. *TNX Electronic Engineering Times, Issue 791, April 4, 1994.*

Key Bored?

Add some zip to your CW keying with the KK-1 Keyboard Keyer from AEA. The KK-1 turns any AT-compatible keyboard into an easy-to-use, feature-packed Morse machine. Using the provided cable, the KK-1 will even share a keyboard with your computer!

Unique features such as short-term memory, message repeat, and twelve nestable message buffers, make the KK-1 versatile and simple to use. Hone your skills with an extensive code practice mode or use the built-in iambic keyer with your paddles for a change of pace.

With more usable features for your money than any other Morse keyboard, the KK-1 continues AEA's tradition of top-notch keyers.

Take a break from tapping your paddles and call AEA's Literature Request Line at (800) 432-8873 for more information, or call us direct at (206) 774-5554. Contact your favorite ham radio equipment dealer for best pricing.

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MRP4 Solar Panel Control Circuit

Build this easy charge controller for your sun-powered station!

by Michael Bryce WB8VGE

Photovoltaics, the direct conversion of sunlight to electricity, is fast becoming the energy technology of the '90s. It's surprising how much energy the newer generation of solar panels can produce. In the not-too-distant past, you would be lucky to see 1 amp under ideal conditions. Today, a single solar panel can easily generate over 4 amps of charge current under clear, sunny skies.

If the solar array was left connected to the batteries all the time, however, severe overcharging would occur. The results would be rather ugly! You can expect physical damage in the form of warped plates, dislocation of the plate's lead paste and excessive electrolyte gassing, resulting in loss of electrolyte. You can easily destroy a brand-new gelled battery in one weekend if you don't have some means of protecting the battery from overcharge.

To prevent battery damage, some means of controlling the current from a solar panel is needed. This device is called a charge controller.

Charge Controllers 101

There are two basic technologies to charge batteries via solar power: shunt mode and series mode. Let's look a little closer at both methods of control.

In a series controller, a relay or transistor switch is in series between the PV (photovoltaic) array and the battery bank. In this case, the controller monitors the terminal voltage of the battery and will turn off the switch when the battery becomes full. Controlling how long the switch remains open or closed determines the state of charge of the battery. By pulse modulating the switch, a trickle charge can be emulated.

As the name implies, shunt controllers divert array power from the batteries by shunting the PV array to ground. A blocking diode isolates the PV array from the batteries. This prevents the controller from discharging the battery bank along with the array when the array is shorted to ground. By monitoring the terminal voltage of the battery, the controller will start to shunt the extra current when the full charge terminal voltage is reached. Many times, the array's energy is dissipated as heat, usually by resistors. Sometimes the array is shorted directly to ground.

You can short the output of a solar panel to ground without causing any damage to the panel. Here's how it works: Power is a function of both current and voltage—power is equal to current times voltage. With nothing connected to the panel, we have zero power because there is no current flowing. Voltage is maximum, current is zero. On the other hand, shorting the output of the panel generates maximum current, but now there is no voltage. The result is again zero power being produced. In real life, using real-life switches, there will be some voltage drop. Therefore, some of the energy from the panel will be released as heat. Since most shunt controllers use a power transistor as the switching device, the collector-emitter junction will drop some voltage. This is exactly how a shunt controller works.

The MRP4 Charge Controller

The MRP4 is a simple shunt charge controller that will handle up to 4 amps of array current. That's enough for a Siemens ProCharger 75 panel. The MRP4 will allow the battery to be charged to 100 percent of its capacity without overcharging. It's simple to set up and, best of all, easy to build. A well-stocked Radio Shack can supply nearly all the parts. A PC board is available, as well as a complete kit of parts. You can build the MRP4 for less than $35—much less with a well-stocked junkbox.

A Look at the Circuit

The MRP4's schematic is shown in Fig-

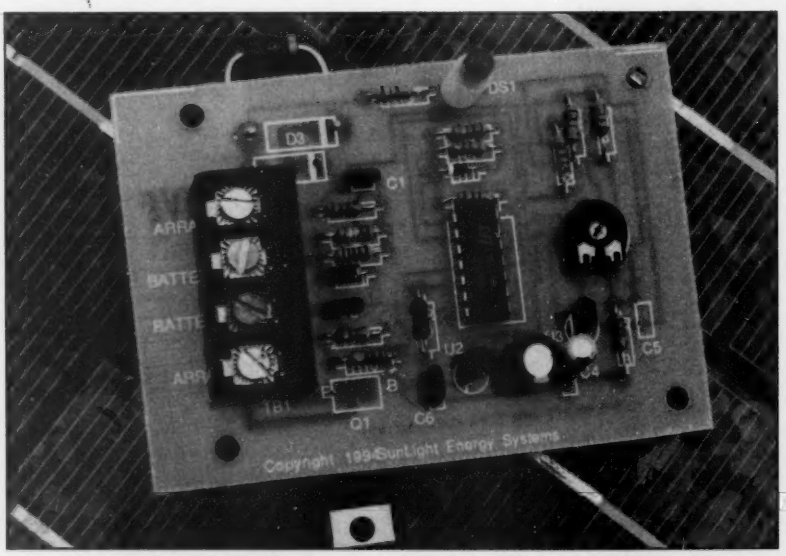

Photo A. The MRP4 Solar Panel Control Circuit. The chip is an LM324 op amp.

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You get MFJ's *automatic notch filter* that searches for and eliminates *multiple* heterodynes.

You also get MFJ's advanced *adaptive noise reduction*. It silences background noise and QRN so much SSB signals sound like a local FM repeater.

The *automatic* notch filter and *adaptive* noise reduction can be used with *all* tunable and pre-set filters.

Automatic notch filter

MFJ's *automatic* notch filter searches for and eliminates *multiple* heterodynes in *all* filter modes -- it's so fast interfering CW and RTTY signals are also eliminated.

If you leave the *automatic* notch filter on during a phone contest, you'll never be worn down by the heterodynes of tuner-uppers.

Voice signals aren't degraded. The *narrow* automatic notch is silently working in the background destroying unwanted tones when they appear.

With up to 50 dB attenuation, you'll copy stations that would otherwise be masked by heterodynes. You'll miss fewer calls and be less exhausted when the contest is over.

When you need to *selectively* remove tones -- like when you're enjoying a CW ragchew and a couple of annoying CW stations appear nearby -- you can use the *two* MFJ *tunable* notch filters to completely knock them out.

Adaptive noise reduction

Pressing the "ON" button silences background noise. Some SSB signals sound like a local repeater! It makes noisy FM and AM signals readable and works with CW, Data and other signals.

It works in all filter modes and on all types of random noise including -- white noise, impulse noise, static, ignition noise, power line noise, hiss and atmospheric noise.

The LMS algorithm gives you up to 20 dB of noise reduction depending on the type of noise. You can adjust the amount of noise reduction to prevent distorting some signals.

Reducing random noise reduces fatigue and makes QSOs more fun -- especially, when the band is full of tiring noise.

Tunable highpass/lowpass filters

For Voice and Data nothing beats MFJ's exclusive *tunable* highpass/lowpass FIR linear phase "brick wall" filters.

You can *tune* the lower cutoff frequency 200 to 2200 HZ and the upper cutoff frequency 1600 to 3400 Hz.

Signals *just 75 Hz* away literally disappear -- they are reduced a *thousand* times, 60 dB!

Unlike other filters, speech clarity is not reduced by envelope distortion caused by unequal time delay.

By adjusting the highpass and lowpass filters you can create *custom* filters for Voice, Data and other modes.

When signals are weak, you can improve copy by removing high and low speech frequencies. They contain little information but are full of noise that reduce readability.

On crowded HF bands, overlapping SSB signals make copying difficult. You can improve copy by slicing off some overlap with razor sharp "brick wall" responses.

You can also highpass filter out hum, pulses, rasp and other irritating low frequency noise.

Tunable bandpass filters

Narrow band signals like CW and RTTY jump out of QRM when you switch in one of MFJ's three *tunable* FIR bandpass filters.

You can *tune* the center frequency from 300 to 3400 Hz. And *vary* the bandwidth from 50 Hz to 680 Hz -- from super tight CW filters to wide razor-sharp Data filters.

As you narrow the bandwidth, interfering signals just drop out because, just 60 Hz away, they're down by over 50 dB.

You can use *narrower* bandwidths to fight tough QRM because these linear phase filters don't distort signals with unequal time delays.

Even with the narrowest 50 Hz bandwidth, you'll never have a problem with ringing.

One position gives you *two* tunable filters you can use together on one signal. For example, on RTTY, tune one filter to mark, the other to space and set each bandwidth tight for an incredibly sharp RTTY filter.

16 *pre-set* filters -- use factory set or program your own

With a turn of a switch you can select from *sixteen* convenient *pre-set* filters. You can use them for SSB, AM, CW, packet, AMTOR, PACTOR, RTTY, SSTV, WeFAX, FAX or any other mode you can think of.

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Only MFJ gives you the best of both worlds -- *tunable* filters to eliminate nearly any QRM and fast convenient *pre-set* filters customized for any mode.

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A push-button quickly bypasses your filter so you can hear the *entire* unfiltered signal and see if anyone is calling you.

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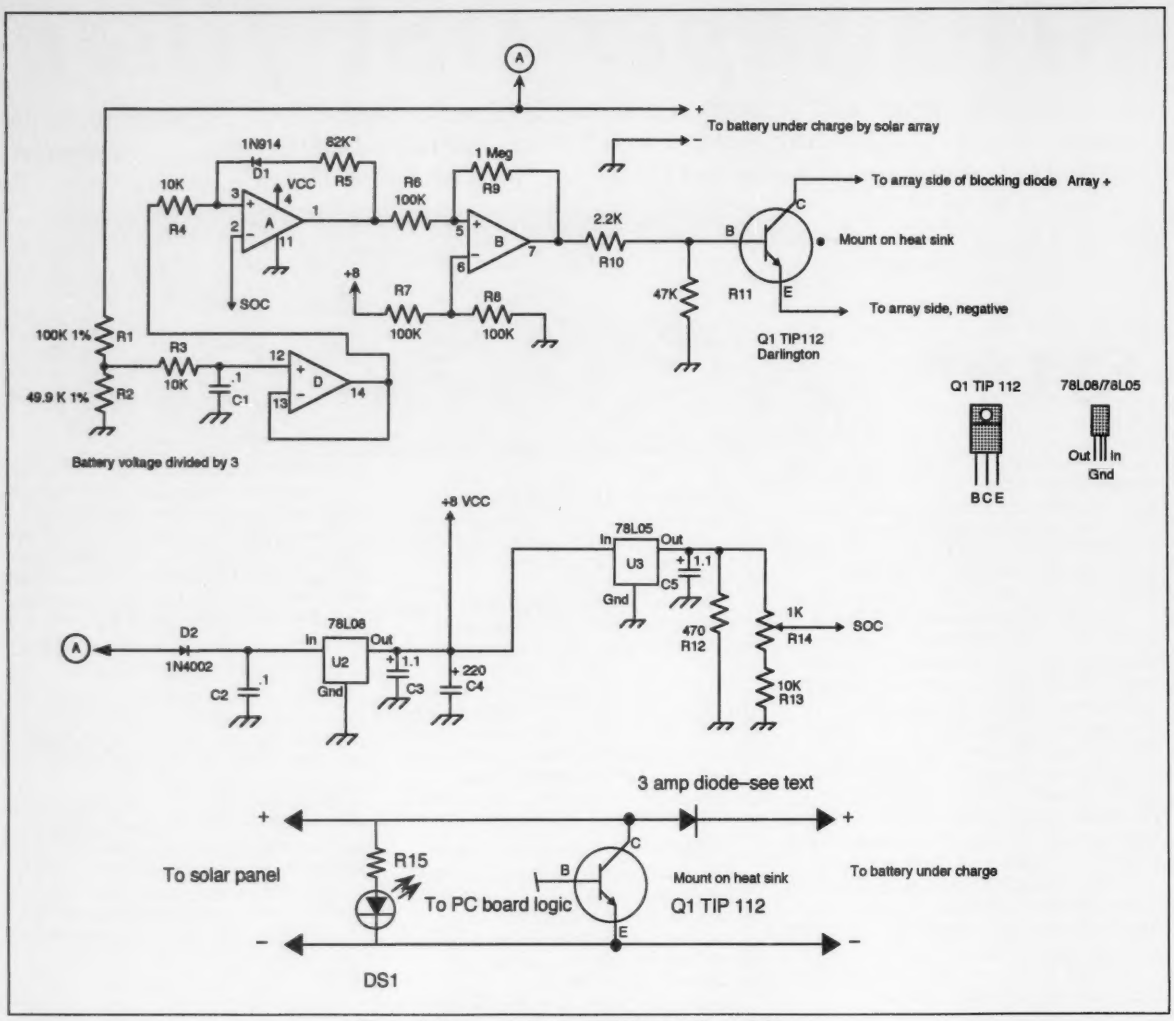

Figure 1. Schematic for the MRP4 Solar Control Circuit.

ure 1. The heart of the project is an LM324 op amp. Only three of the four amplifiers in the chip are used in this project.

To determine the state of charge of the battery, we monitor its terminal voltage. Resistors R1 and R2 divide the battery's voltage by three. Amplifier D buffers this voltage before passing it along to amplifier A. This amplifier is configured as a voltage comparator. The battery's terminal voltage, now divided by three, is compared to the state-of-charge reference voltage.

The state of charge (SOC) is determined by a 78L05 three-terminal voltage regulator. Resistor R12 keeps a constant load on the regulator to improve its stability. Trimmer R14, along with R13, sets the state of charge by dropping the regulated +5 volts slightly. This is our state-of-charge set point. The state-of-charge set point is three times the value. If you want the controller to turn off the charging current at 14.3 volts, then the SOC voltage at pin #2 of U1A would be 4.766 volts. The highest you can set the state of charge is 15 volts. That's the full output of the 78L05 regulator times three.

Even though the battery sense is divided by one-percent resistors, there may be some final adjustment needed to the SOC trimmer for the exact state-of-charge voltage at the battery terminals. The circuit is protected against reverse polarity by a 1N4002 diode.

When the array starts to produce energy, all the array's power goes into the battery via the blocking diode. As the battery becomes full, its terminal voltage will rise. When the terminal voltage reaches the state-of-charge set by R14, the comparator switches states. Some of the output is fed back to the sense line. This raises the voltage of the sense line up slightly. By doing so, we introduce some hysteresis to the comparator.

At the same time, the output also is squared up by the third amplifier. Its output drives the shunt transistor fully on. Since the transistor is fully saturated, it shorts the array to ground. This stops the battery from charging. The blocking diode prevents the battery from being shorted to ground when the transistor turns on.

With the array shorted to ground, the terminal voltage of the battery begins to drop. But, because of the hysteresis, the terminal voltage drops below that of the state of charge. Depending on the value of the resistor in the hysteresis loop, the battery voltage will drop a volt or so. When the terminal voltage drops below the hysteresis threshold, the comparator switches off. This reverses the action of the transistor switch, turning it off. Once again, full array current is allowed to flow into the battery and the process is repeated. The battery is then protected from overcharge by shorting out the array when the state of charge has been reached.

The CHARGING LED will then flash on and off as the shunt transistor shorts the array to ground. The CHARGING LED gets its

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operating power directly from the PV array. The rate of flashing will be determined by several factors, such as the charge current from the array and the condition of the battery.

Construction

There is nothing critical about building the MRP4. It can be built using any method you're comfortable with. This includes the use of perf board and dead-bug construction. However, using the PC board designed for the MRP4 speeds construction. The PC board makes troubleshooting easier, too.

This is a simple project, so begin by stuffing the PC board with the resistors. Next add the IC socket and the terminal board. Finish up by installing the regulator and capacitors. The shunt transistor must be heat-sinked. Failure to do so will destroy the device. You can use an aluminum TOP220 heat sink or, by bending down the tab of the transistor, you can use the metal case holding the PC board. If you go this route, be sure you use a TOP220 mounting kit to keep the tab insulated from the case. Likewise, you can bend down the blocking diode and use the case to help heat-sink it, too. Apply a small dab of thermal compound to help conduct the heat to the metal.

Setup and Adjustments

You'll need an adjustable power supply, a digital VOM and a solar panel to adjust the MRP4.

Start by connecting the power supply to the battery terminals. With the power supply sitting at 14 volts, check for VCC on pin #4 of U1. Check the output of the 78L05 regulator. It will be very close to +5 volts. From the wiper of trimmer R14, set this voltage to your state of charge. Remember, it will be your state of charge

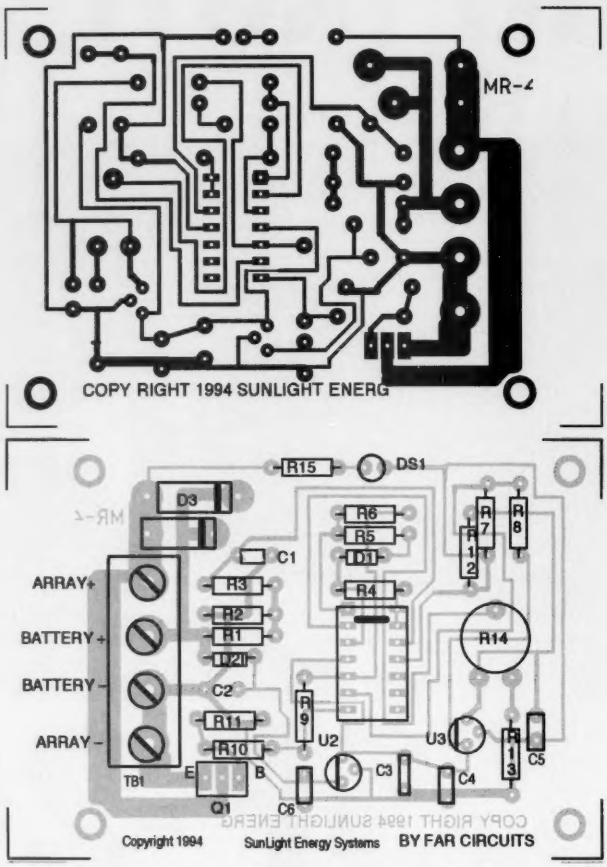

Figure 2. A drilled and etched PC board is available for $4.75 plus $1.50 S&H per order from FAR Circuits, 18N640 Field Ct., Dundee, IL 60118.

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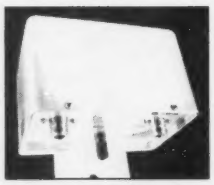

Model 146 $165
Model 146OS $165
Model 440 $179

Model 146 160W 2 Meters 19db Gain .75db Nf
Model 146OS 160W 2 Meters 19db Gain .75db Nf
Model 440 70cm 100W 16db Gain .75db Nf

All preamps have helical filters to prevent out of band intermodulation in the receiver. Model 146 covers the entire 2 meter band. Model 146OS is of very narrow bandwidth and would be suitable for SSB. Packet, or Satellite. Model 440 is factory tunable from 430–440 MHz or 440–450 MHz per customer request. All models are powered with 13 to 20 VDC and are mounted at the antenna.

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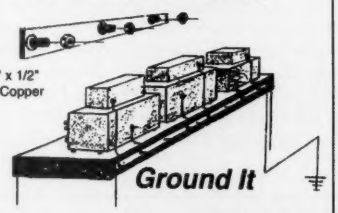

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← Incoming data

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3>CANNED     MSG
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divided by three.

Probe the base of Q1 with the VOM. Now slowly increase the power supply voltage. When the power supply reaches the state-of-charge set point, the base will go high. Now slowly reduce the voltage of the power supply. You should be able to drop the voltage down to around 13.5 volts before the base goes low again. This completes the setup and adjustment. You might need to touch up the trimmer if you don't see the exact set point you require. Again, this is because of the slight difference in com-ponents in the battery sense line. During these tests, the charging LED will remain dark.

Final Hook-Up

The only way to really see how the MRP4 works is with a solar panel. So, connect the MRP4 to the battery to be charged first. Then connect the solar panel. Of course, the solar panel needs to be placed in direct sun to charge the battery. The CHARGING LED will come on. When the battery reaches full charge, the charging LED will begin to blink on and off. With an MP75 solar panel, the shunt transistor's heat sink should be politely warm to the touch. Don't use any other source of energy other than a solar panel. Don't use your power supply!

Any time the array produces power, the LED will come on. This may occur without any substantial charging taking place. In fact, bright moonlit nights may make the LED glow slightly!

Parts List

R1	100k 1%
R2	49.9k 1%
R3	10k
R4	10k
R5	82k
R6	100k
R7	100k
R8	100k
R9	1 meg
R10	2.2k
R11	47k
R12	470
R13	10k
*R14	1k
R15	1.8k
C1	0.1
C2	0.1
C3	1.1 TAN
C4	200 µF
C5	1.1 TAN
D1	1N914
D2	1N4002
D3	1N5821
U1	LM324
U2	L8LO8
U3	L8LO5
Q1	TIP 112
Heat sink, solder, etc.	
*Trimmer	Mouser #531-PT10V-1k
Terminal block	Mouser #506-4PCV-04

You can change the TIP 112 to a power MOSFET if you wish. The pins of the MOSFET will fit the same holes as the TIP 112. Change R10 from 2.2k to 100 ohms and R11 from 47k to 100k. Nothing else needs to be changed for this modification. You can use just about any low RDSon power MOSFET instead of the TIP 112. I've used an IRFZ44 in the past with very good results.

For more current capacity, there are two extra pads on the PC board for a second 1N5821 diode in parallel.

A PC board is available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118, for $4.75 plus $1.50 S&H.

A complete kit of parts, including the PC board and terminal block, is available for $30 (including first-class postage) from Sunlight Energy Systems, 2225 Mayflower NW, Massillon OH 44647.

Uh-Oh! It Don't Work!

If the MRP4 fails to operate, check for VCC on pin #4 of the LM324. Also, you must have the proper reference voltage from the 5 volt regulator.

If the battery won't come up to the state of charge, you may have more load on the battery than the solar panel can replace. Either reduce your loads or increase the charging current to the battery.

An open shunt transistor will allow the battery to become overcharged. Check the base voltage to see if the device is being turned on. If there is base voltage, and the battery is overcharging, then Q1 has failed.

By connecting the solar panel only, with no battery connected to the MRP4, you'll overheat the shunt transistor. This happens because the MRP4 oscillates by turning itself on and then off. Be sure there is a battery connected to the MRP4 when the solar panel is active.

That's It!

The MRP4 will protect your battery from overcharging when you're using a solar panel. It's simple, effective and oh so easy to build. It's a perfect project for a rainy afternoon. 73

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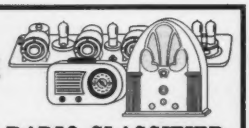

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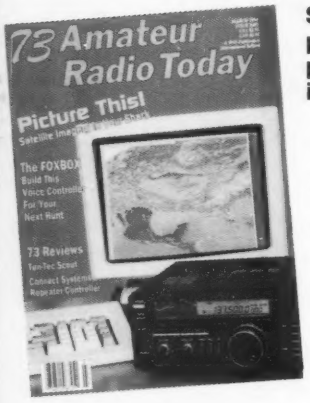

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9 Review: Midland Corporation's 18-300, 18-325, and 18-330B
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Surplus Solar: Is It for You?

An affordable alternate backup power system.

by Donald Koehler N7MGT

Looking for a back-up power source for your station? Want some way to power your equipment that is portable, quiet and earth-friendly? Solar power systems will give you all of this and a bit more. The major objection against solar power from most hams seems to be the cost associated with the system components, especially the panels. This article shows how you can use surplus or repaired panels to reduce your system costs.

New panels, tied into a modern "turnkey" system, can't be beat for overall price, efficiency and hassle-free power. Hams, however, have a demonstrated do-it-yourself attitude, both to save money and to learn more about their equipment and their system's maintenance. With the use of surplus panels, described here, and surplus batteries, described in companion article on page 22, you can save a considerable amount over an all-new system.

What About Surplus Panels?

Current prices are much better than in the past, under $10/watt for new commercial panels. New solar panels are often more efficient, producing more watts per square foot of surface area.

Older panels are, for the most part, repairable. These older panels, made from large round silicon cells or smaller square cells, are hitting the surplus market at very attractive prices. Commercial surplus panels are available for about $4/watt, less shipping. Damaged panels can often be obtained for free locally when purchasing other working panels.

Typical surplus sources for panels are local land mobile (commercial two-way) radio providers, railroad surplus, and small solar dealers. I have listed some sources for new and surplus panels at the end of this article. Don't forget to look here, in the pages of *73*; several companies routinely advertise surplus panels.

Besides the obvious sources listed above, try some of these:

- Billboard maintenance and sales companies
- State highway sign maintenance shops
- Oil and gas pipeline operator/service providers
- Local water/waste water and electrical utilities, especially those with extensive SCADA systems
- Canal and irrigation systems service organizations
- Salvage dealers, commercial and military

Last, but not least, get some magazines, such as *Mother Earth News, Backwoods Home Magazine* or *American Survival Guide,* or others found in your local bookstore or library, then check out the ads. Write for catalogs and ask about surplus, damaged or over-age/canceled orders. Also check on the local repeater—you never know what will turn up.

Testing the Panels

As with anything you may purchase which is labeled surplus, always test the panels before you hand over your hard-earned cash. This way you'll know how many watts you are really getting, not just the panel rating. It takes little effort and just a few basic tools to check the panels. The minimum tool requirements are: a digital voltmeter, an ammeter or shunt for your VOM, and a variable load.

First, give the panel a close visual inspection (see Photo A). Look for cracked cells, lifted or broken interconnect foils, or delaminated surface or backing covers. Once satisfied, attach your voltmeter and ensure that it is on a high DC setting. Point the panel at the sun and read the voltage produced (see Photo B). Write down this indication, then attach a load. I use an old, wire-wound, military surplus rheostat to provide a variable load. Never use a radio or other equipment to check the output of an unregulated panel—you may damage the gear. Unloaded panels can generate anywhere from 18 to 30 VDC at several amperes current, enough to fry your radio or other equipment.

The load should have an ammeter or shunt connected, in series, to read the current produced by the panel. Hook the ammeter PLUS (+) lead to the PLUS (+) lead of the panel. Then hook the ammeter minus (-) lead to the load. The return is from the load to the panel. WARNING: Always hook up an ammeter through a load; used like a voltmeter, the ammeter will be damaged. All set? Now

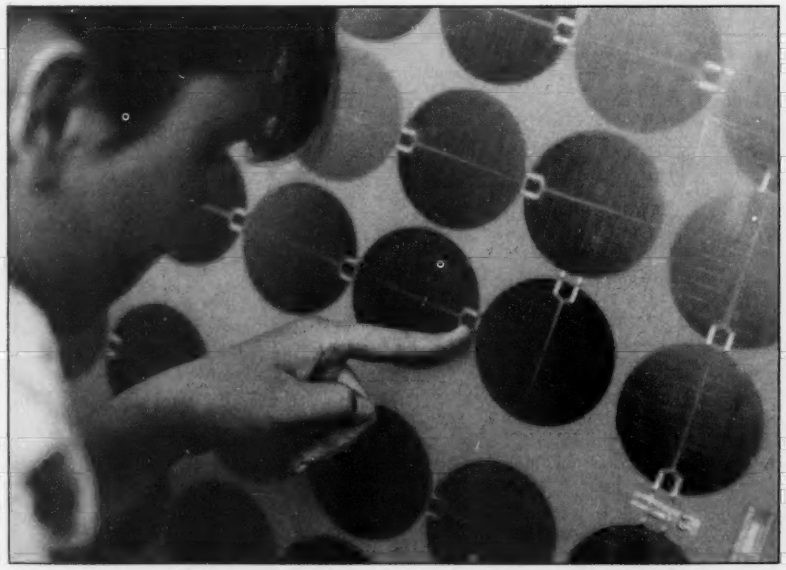

Photo A. Close visual inspection is the first step in testing surplus panels.

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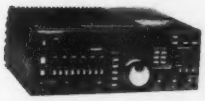

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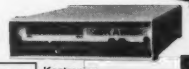

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point the panel to the sun and read the voltage and current.

Slowly reduce the resistance of the load to increase the current flow produced from the panel. At some point the voltage and current will drop off. Back the load off a bit and note the maximum voltage and current readings. At the same time, take a moment to note the resistance of the load and write it down with all the other data. The rest is easy as pie.

Power equals voltage times current. Power (P) = Current (I) times (X) voltage (E). As an example, a panel you have under test may produce 2.5 amps at 12.5 volts. The panel rating, as measured, is 31.25 watts. Keep in mind that this output will depend on total solar insolution or the rate of delivery of direct solar radiation per unit of horizontal surface area. Simply put, more sun striking the panel produces more power, thus a lower sun angle or shadow results in less power.

What Else to Look For

Anything else to look for while bargain hunting? Added features to look for in a panel are bridging diodes. In newer panels, these diodes allow the panel to continue to produce power even if it is damaged. These panels are worth more than the older type panel pictured in Photo A. Panel frames, interconnect wiring and any tracking devices available should be picked up as part of any deal, if possible. These can improve efficiency of the system and save many of the problems of mounting the panels once home. Use care and the proper gauge of wire and fuses to hook panels to your battery bank. Read the companion articles on finding and testing surplus batteries (page 22) and building a controller circuit (page 10) to complete your system.

Other sources for commercial surplus panels:

SUNELCO Inc., 1-800-338-6844 for orders, P.O. Box 1499, Hamilton MT 59840.

Solar Electric Inc., 4901 Morina Blvd #305, San Diego CA 92117.

Kansas Wind Power, Route 1BW22, Holton KS 66436.

Integral Energy Systems, 109M Argall Way, Nevada City CA 95959.

Photocomm, Inc., 7681 East Gray Road, Scottsdale AZ 85260.

UNI-SOLAR, 1-800-397-2083 for product information, 5278 Eastgate Mall, San Diego CA 92121-2814. 73

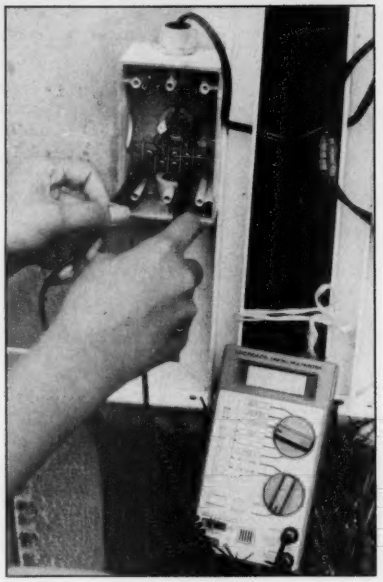

Photo B. Test the panel, using care to observe the polarity of the panel output.

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- Inhibit ID with active high or low. Will hold off ID until channel is clear of traffic.
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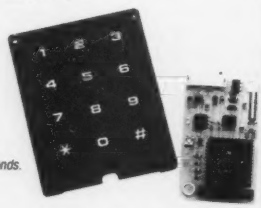

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Fits Icom, Yaesu, Alinco, Ramsey and Radio Shack rigs! Looking for a handy little speaker-mike to compliment your FX transceiver or other ICOM style handie-talkie? The Ramsey SM-1 speaker-mike is a beauty. It's only 1 1/2" wide by 2 1/2 inches high and has a handy clip on the back so you can easily clip it to your lapel or shirt. Its small internal speaker isn't going to break any eardrums but is very clear and has plenty of pop to be heard when worn. There's even a jack on the mike so when you plug it in, you still have the use of the speaker jack from your radio. Fits all Radio Shack, ICOM, Yaesu, Alinco and Ramsey rigs.

SM-1 Mini-Speaker mike,
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CW-700 Micro keyer kit.....$69.95 MK Matching case set.....$14.95
CW-700WT Assembled CW-700and case $119.95

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Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

AA-7Kit.....$28.95 Matching case & knobset, CAA..$14.95

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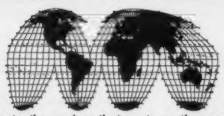
Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit $29.95
Matching case set, CAR $14.95

SHORTWAVE RECEIVER



Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

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Shortwave converter kit, SC1.....$27.95
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2M POWER AMP

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Ramsey carries a complete line of low cost, easy to build, easy to use functional kits that can be used alone or as building blocks in larger more complex designs. Mini-kits include audio amps, tone decoders, VOX switches, timers, audio alarms, noise-makers and even shocking kits! Call for our free catalogue!

MORE KITS NEXT MONTH'S ISSUE

FOXHUNT HEADQUARTERS

Locate hidden or unknown transmitters fast. The Foxhound direction finder connects to the antenna and speaker jack on any radio receiver, AM or FM from 1 MHz to 1 GHz. The antenna (a pair of dipole telescopic whips) is rotated until the Null meter shows a minimum. A pair of LEDs indicate to turn Left or Right. The Foxhound is ideal to use with a walkie-talkie. if you wish to transmit, go ahead, a built-in T/R switch senses any transmitted RF and switches itself out of circuit while you talk. It doesn't get any easier than this! We provide all parts except for a few feet of 1/2 inch PVC pipe avialable at any hardwar e store for a dollar or two. Add our matching case set for a complete finished unit. Be the one with the answers, win those transmitter hunts and track down those jammers, you'll do it all with your Foxhound.

Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller.The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics, have a foxhunt!

DF-1 Foxhound direction finder kit.....$59.95 CDF Matching case set for DF-1 ....$14.95
FHT-1 SlyFox Foxhunt transmitter kit .$129.95 FHID-1 Voice ID option.....$29.95
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DN-1 Dr. Ni-Cad conditioner/fast charger kit $49.95
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CIRCLE 34 ON READER SEVICE CARD

Used Batteries for Ham Stations

Another way to save money on power systems.

by Donald E. Koehler N7MGT

How can you save money on batteries to use at home for solar or back-up power systems? For small stations or any other purpose with limited equipment requirements, purchasing used or surplus batteries may be your best value. This article will explore the where and how of buying used batteries, and will also describe sources, test procedures, and cautions.

Before You Buy

First, when is a battery no longer a battery? Answer, when it is toxic waste or hazardous waste! Before you even start looking for used batteries, find a recycler or salvage business which will take in "dead" lead-acid batteries. Even in the best of deals, I have had to purchase "lots" of used batteries which contained the occasional dead battery. It is better to know you have a place for the legal disposal of any of these batteries before you start. While on the phone, ask what the center will pay for used batteries.

Now then, take a moment to determine the voltage and current requirements for your equipment. Inverters, devices which turn DC current into AC current suitable for regular home appliances, are rated in both volts and amperes. You will find this information on the manufacturer's data plate. If operating DC-powered equipment like a portable HF station or scanner, add up the current draw from each piece of equipment that will be operating together. Write down this total current requirement. Your total battery bank capacity should be at least twice this number for the longest battery life in your system.

For the sake of this article, I will assume you will use equipment requiring 12 or 24 volts and the current draw won't be much more than 30 amperes. Higher current levels will require you to really look closely at engineering practices beyond the scope of the information presented here.

WARNING: While the *voltage* of these batteries may appear to be low, the *current*-producing potential is lethal! See the sidebar for battery safety tips.

What kind of battery will fit your needs? By and large, "flooded cell" or wet cell lead-acid batteries are the easiest to find and least expensive. Gelled-electrolyte and NiCd batteries may be the next best bet for low-current demand applications, typically communications equipment. Any battery you consider should be a "deep-cycle" type. Automotive or truck batteries can be used, they just won't last very long in a solar/battery/inverter system. A good deep-cycle battery, even one you purchased used, should give more than five years of useful service life. New batteries will go more than 10 years; in properly-engineered "float" systems, double that service life can be expected.

Sources for Used Batteries

Start with the local phone book to develop a list of potential sources where you can purchase used batteries. Try local golf courses,

Photo A. These batteries were free for the taking—240 amp/hr. capacity for the effort of hauling them away.

material-handling equipment companies, local exchange carriers (the phone company or local cable company), large computer operations (such as banking centers) or, if you're near a military installation, the Defense Reutilization and Marketing Organization or salvage yard. Now let's take a look at each source.

Golf courses in urban areas typically use electric golf carts. These carts typically have six batteries, each one rated at 6 volts direct current (VDC). These batteries are also deep-cycle and capable of large current production. Small enough to move by hand, they are my favorite for small solar systems. Most good-sized golf courses buy batteries by the pallet load and the turnover in used batteries is high. Talk to the greens-keeper or someone in the cart barn. Expect to pay about $3 each. Before you pay, be sure you test the batteries you buy. If you establish a long-term relationship with that golf business, the possibility exists that you can "buddy up" with the course on a battery buy. This will net you a pallet load of identical batteries at a better price than you could get on your own. If a pallet load is too many batteries for your specific needs, split it up with friends.

Material-handling companies that sell or service electric forklifts or pallet movers are another place to try. Batteries used in material-handling equipment tend to be very large and heavy. Local exchange carriers like the phone company use either "glass-wall" cells or large conventional lead-acid batteries. Be careful—a friend of mine picked up a load of glass-wall cells "as a good deal" and some were leaking. The local recycler wouldn't touch them. It cost him major bucks to legally dispose of the now-hazardous waste! I mention these two sources only as a comparison. Very few folks have a need for the current levels these kinds of monsters can produce.

If you are going to power your entire home exclusively with solar recharged batteries, then by all means look for large glass-wall cell arrays. Telco batteries generally have excellent records on service and age. The cells are usually 2 VDC, so it is easy to set up 12 or 24 volt arrays. After all, batteries are where you find them.

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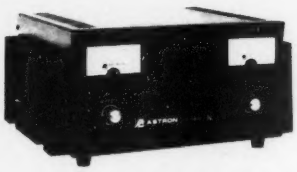

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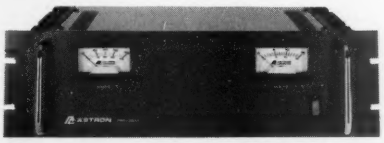
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅞ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES

MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

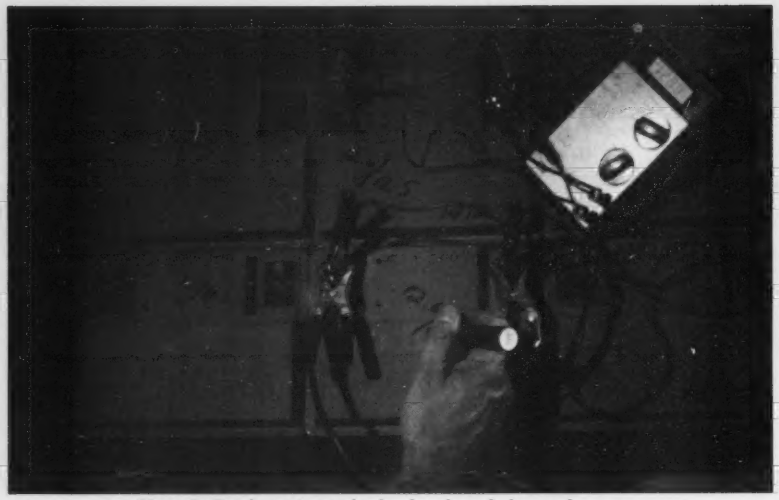


Photo B. Test batteries under load and mark the results on top.

Computer centers with large Uninterruptable Power Systems (UPS) may be a good source of high quality, deep-cycle batteries. About the size of a large auto battery: These cells are small enough to move by hand and most are the gelled-electrolyte type. The cells have "lived" in a well-engineered system, so even cells that are more than five years old should be good for home use. As always, test before you buy. Check with the operations or maintenance supervisor of the local banking or credit card center.

The last source is the Defense Reutilization and Marketing Organization, or DRMO, on a military base near you. This source represents a real crapshoot. My experience is that the folks who work at the DRMO are friendly and helpful, but you have to know what you are looking for in a battery. They can also poll DRMOs in other states or at other bases to see if anything like what you are seeking is available. The big bonus: The batteries they sell are clearly marked as to condition, age and type. Most of the lead-acid and NiCd batteries they sell have been neutralized, to be sold as scrap metal and cannot be re-activated. These can be recognized by the holes drilled into each cell and they will usually be marked with a bright red tag. Sometimes batteries can be found that are still usable. The price is usually pretty good, but the sales are by "lots." Before attending any auctions, go inside and ta!k to the friendly folks. They really want to sell you something, so ask their advice. I have always received good treatment and a fair deal. Now, how do you test the darn things?

"Before attending any auctions, go inside and talk to the friendly folks. They really want to sell you something, so ask their advice. I have always received good treatment and a fair deal."

Testing Used Batteries

The testing of used batteries is not hard and is a two-part process. You will need a couple of tools. First, a good quality digital voltmeter. Available from retail stores like Radio Shack, they run about the same as an analog (pointer) meter. Second is a "load," something to draw current while you check voltages. I use an old automobile headlamp. The other instrument is a thing called a hydrometer. This is used to check the specific gravity of the battery acid in a wet cell. Be sure you tell the salesperson you will be checking batteries containing acid. You can use the kind that has little floating balls in a tube, available at local auto parts stores or service centers.

Now, another word about safety. *Before* you go out to check and test batteries, let's review some basic safety procedures. One: The darn things are heavy! Use your legs and not your back to lift or move batteries. Second: They contain a powerful acid. When you go to check specific gravity, wear gloves and eye protection! If you are like me, you will follow the advice of professionals and wear a rubber or acid-proof plastic apron, shoe covers and long-sleeved shirts. Old clothes are a must here!

Look at the batteries prior to testing. Are they clean and free from cracks and leaks? Do all of the cells have liquid in them, enough to cover the plates? Are the terminals solidly attached (do they move)? Do the cells each have their own caps or covers, and do they match? They do? OK, let's move on.

Now you are ready for the first test! Take the battery you will test and attach the test leads from your digital voltmeter, being sure to use the correct polarity on the leads. Read the voltage. On a 6 volt battery, fully charged, you should see about 6.3 VDC registered on the meter. Now attach the load. On my auto headlamp, I use a set of old jumper cable clips to allow attachment to the battery under test. The advantage of the headlamp is that I can see it light up, so I know it is pulling current from the battery. The lamp is equal to about a 35 watt load.

With the load attached and drawing current, read the meter. It should not have changed from the first reading. If you are checking several batteries, use a piece of chalk and mark the battery with the two voltages. For instance: 6.3/6.2. Continue on with the rest of the lot. Now you can see, at a glance, which batteries hold up best under a load. Once the batteries are marked, you are ready for step two.

Take your hydrometer and check the

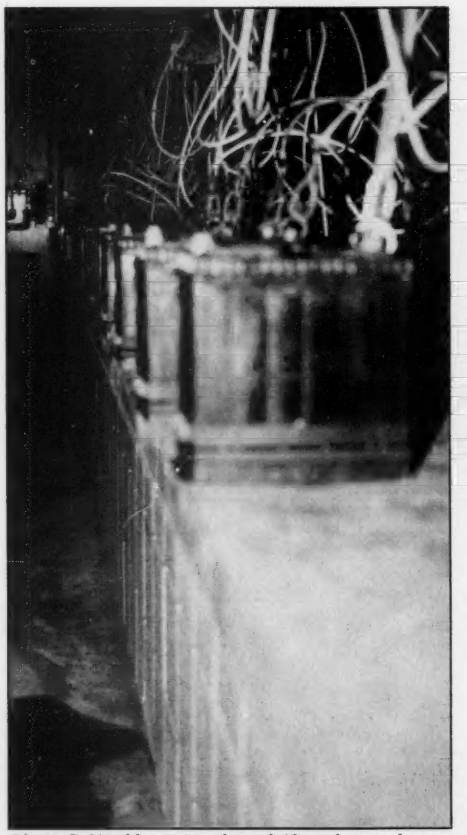
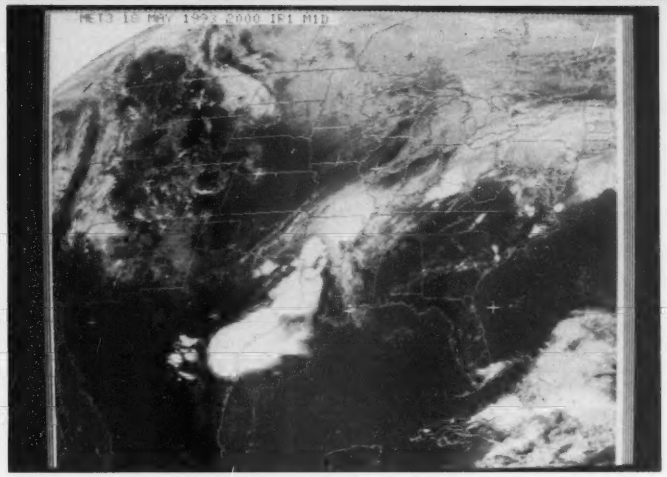
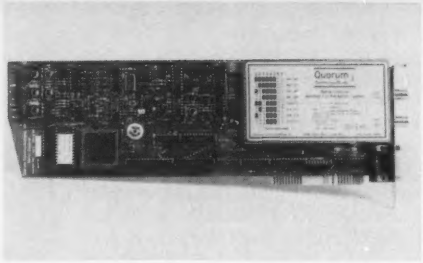


Photo C. Used batteries abound, if you know where to look.

Explore The World of Quorum Wefax





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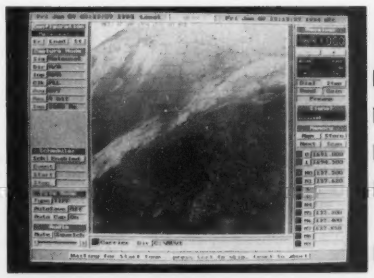

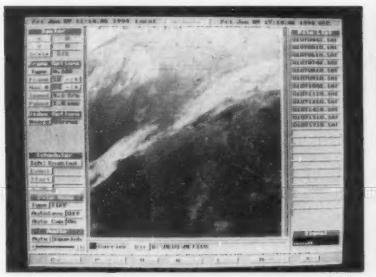

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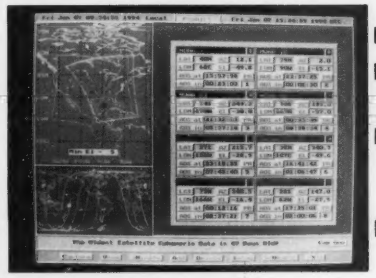

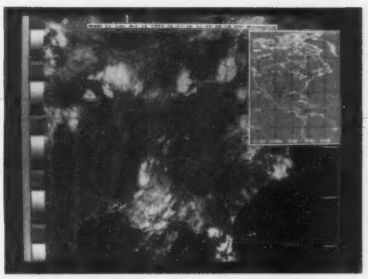

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CIRCLE 257 ON READER SERVICE CARD

specific gravity (SG). This is a pass/fail kind of test, since it shows the state of battery charge; it does not prove that the battery is good. The specific gravity depends on the type of battery you are testing. Ask what it should be—figures can range from a high of 1.300 to a low of 1.65/1.75. Batteries used in cold climates have an SG of around 1.300. In warmer climates, an SG of 1.65 will allow more current to be pulled from a system battery. Temperature will affect the SG and capacity of the battery. (NOTE: A battery may lose most or even all of its capacity in cold temperatures.) If the battery does not meet the minimum SG, think again about parting with your money.

Remember, clean batteries work better and last longer than batteries which are dirty or corroded. Keep the terminals and outside of the batteries clean—you will save both time and energy.

Now then, how much to pay? Depends. I pay about $3 for used golf-cart batteries, as that is the salvage price. If the battery looks in good shape, passes the tests and is the right size for your needs, go a bit better than the salvage price. Look at it this way: You are saving the owner the cost of hauling his batteries to the recycling center. That is the other reason you checked the price paid by the center first. Drag it home, hook it (or them) to your system and enjoy the fact that you are helping the environment while saving money.

Thanks to the real experts at the 3rd Wing, Elmendorf AFB (AK) battery shop for the DRMO and battery info. 73

Safety Warnings

Batteries can be dangerous—pay attention to these common-sense safety rules!

- Keep batteries away from children or pets.
- Personal Protective Equipment (PPE): Minimum safety equipment includes acid-proof gloves, eye protection and heavy leather shoes; strongly recommended is an acid-proof apron, shoe coverings and a long-sleeved shirt.
- Batteries are heavy, so use proper lifting techniques.
- Batteries vent hydrogen gas when charging, so make sure your storage/use area has enough air flow to prevent buildup of explosive gases.
- DO NOT SMOKE around batteries, charging or not.
- Use a regulator when charging batteries from a solar system or other unattended method.
- DO NOT MIX battery types or voltages.
- In earthquake country, secure the battery so it won't move or spill.
- It is OK to set batteries on a concrete surface. However, any spilled acid may ruin the concrete.
- Protect terminals so they cannot be shorted together.
- If in doubt, check with a professional battery service organization or dealer. Be safe, not sorry.

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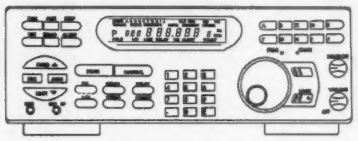
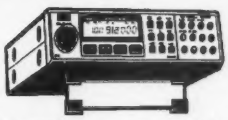
Continuous Coverage



Three new Bearcat units offer expanded coverage and more memory than before. The 890 offers 200 channels, base/mobile operation, VFO tuning, service search, weather alert, search and store, and more. The 2500 hand held has 400 channels, fast scan and more. The Bearcat 8500 has 500 channels in 20 banks, VFO, auto store, alpha numeric display, 10 priority channels, aux tape output jacks, and coverage to 1.3 Gigahertz,

Bearcat 2500XLTA hand held.....$349.95
Bearcat 8500XLTC mobile.....$389.95
Bearcat 890XLTB mobile.....$259.95
25-1300MHz, 500 ch. in 8500, 400 in 2500. 890 has 200 ch.& 29-956MHz. All cell locked. Features include turbo scan, VFO, search and store, Priority, LCD display, and more. Fax Facts474,475,476

Mobile Scanners

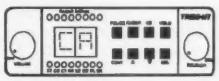


Bearcat
760XLTM
$219.95
100 Channel
800 MHz

Five banks of 20 channels each. Covers 29-54, 118-174, 406-512 and 806-954MHz (with cell lock). Size: 4 3/8 x 6 15/16 x 1 5/8. Weight: 4.5lbs. Fax fact document #550

Bearcat
560XLTZ
$99.95
16 Channel
10 Band

Compact, digital programmable unit covers 29-54, 136-174, and 406-512MHz. Size: 7 3/8 x 2 1/2 x 15/8. Wt: 2.5lbs. Fax fact #560



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Sangean ATS-606P	**$169.95**
Sangean ATS-800	**$89.95**

Hand Held Scanners

Bearcat 200XLTN
$209.95 200 Channels 800 MHz
Ten scan banks plus search. Covers 29-54, 118-174, 406-512 and 806 956MHz (with cell lock). Features scan, search, delay, 10 priorities, mem backup, lockout, WX search, keylock. Includes NiCad & Chrgr. Size: 1 3/8 x 2 11/16 x 7 1/2. Wt. 32 oz. Fax Facts # 450

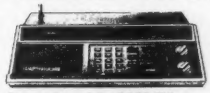
Bearcat 100XLTN 100Ch H/L/U	**$159.95**
Bearcat 70XLTP 20Ch H/L/U	**$139.95**
Bearcat 55XLTR 10 Ch H/L/U	**$ 99.95**

Coverage of above hand helds is: 29-54, 136-174, 406-512 except 100 which also adds 118-136 Air Band. Fax facts #475

Table Top Scanners

Bearcat 855XLTE 50Ch w/800	**$159.95**
Bearcat 142XLM 10Ch H/L/U	**$ 84.95**
Bearcat 147XLJ 16 Ch H/L/U	**$ 89.95**
Bearcat 172XM 20Ch H/L/U/Air	**$124.95**
Bearcat 210 16Ch H/L/U/Air	**$129.95**

Coverage of above units is: 29-54, 136-174, 406-512, plus Air in 172 and 210 and air plus 800MHz in the 855. Fax facts #675



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CIRCLE 164 ON READER SERVICE CARD

All About Those Lightweight HF Ham Whips

Easy mobile operating from 160 to 10.

by Gordon West WB6NOA

Operating mobile high frequency from 160 meters to 10 meters can be a real kick on your next vacation, or on a long commute into work. High frequency 100 watt mobile rigs have been scaled down to a size not much larger than an SSB CB rig. The Kenwood TS-50 is a good example.

If you are cramped for space on the dash, you could remote-mount the Yaesu FT-747, or surely find a spot behind the driver's seat for a microphone-controlled ICOM IC-728.

But newer vehicles may make it a challenge for a simple pre-tuned high frequency whip installation. The extra-thin metal bodies—and now composite bodies—could rule out the old ball-mount found on older-vehicle installations. Forget the bumper chain mount—bumpers are no longer metal. And the old standby gutter mount is now out of the picture because newer vehicles don't have gutters anymore!

But there is hope—with special thanks to antenna manufacturers Comet and Diamond. Their adjustable trunk-lip mounts will grab almost any tiny crevice of your newer vehicle, and they stay on securely with four strong Allen screws that clinch the inside of the groove. Look these mounts over carefully and find one that will work with your type of vehicle. You will find them hanging in clear vinyl bags in the antenna accessory section of your local ham radio store. Most dealers will also have a store sample that they may let you take outside to see how well it is going to work on your vehicle.

While these mounts are strong, you may wish to first start off your HF mobile system with an extremely lightweight, pre-tuned HF antenna whip. In other words, you may ultimately work your way up to a heavy Hustler, a heavy Outbacker, or some of the older very heavy whips from Swan or Webster—but start out "lightweight" first.

Extremely lightweight, one-quarter-wavelength, helical, center-loaded whips are always available at hamfests, seen hanging on a blister-pack card for any single ham band from 160 meters through 6 meters. One whip per band. Examples are:

- Lakeview WD4BUM mobile HF whips
- Valor Pro Am HF mobile series
- Wintenna Hamstick
- ASA Fiberwhips
- Anttron SingleBanders

There may be others, but each of these "different" lightweight whips share similar characteristics:

- Almost identical TX/RX performance as 8-ft. heavyweight whips.
- Incredibly lightweight—15 ounces for 17-meter whip.
- Hollow 4-ft. helical-wound Fiberglas shaft.
- Tunable 4-ft. stainless steel whip.
- 3/8" x 24 ferrule for trunk-lip or ball mounts.
- Low price—seen selling for under $19.95 each at ham shows.
- Change bands, change whips—30 second operation.

To test the "TX/RX performance" of these whips, we hooked up a solid-state transceiver—a unit *without* a built-in antenna tuner—to a professional heavy-duty, 50 ohm, five-position switch, going to the following station wagon roof-mounted antennas for an on-the-air comparison:

- Hustler 1/4 kilowatt, single-band whips
- Outbacker 6-foot whip
- Different manufacturers' Fiberglas/stainless whips
- Nearby house-mounted five-band trap vertical
- Cushcraft three-element beam

The beam always did best. The five-band trap vertical was second-best. The mobile antennas from all of the different manufacturers were certainly no match to the beam, but relatively close to the home-mounted 5 BTV.

When we tested between different mobile whips, including different Fiberglas/stainless whips, there was not one whip that did a whole lot better than the others, nor any one that was substantially down in the mud from the others. The 50 ohm coax switch allowed us to rapidly switch between the different antennas to get away from the typical band condition of up-and-down fading having nothing to do with the type of antenna being used.

Each manufacturer claims superiority over their competition, even though the whips may initially give equal performance.

"The Lakeview whips can take up to 600 watts, and even a kilowatt for a few seconds without going up in smoke," comments Butch at Lakeview. "I have never charged for a warranty repair, and we have never seen water pool in the shaft," adds Lakeview. An inherent problem with these whips could be moisture streaming down the outside of the stainless steel shaft, creeping into the hollow body of the whip, and pooling at the base like a rain gauge. The accumulation of water will dramatically change the base impedance, and could ultimately seep into the mount and cause problems down here. Lakeview claims this has never been a problem because of the tight fit of the tunable whip tip into the top ferrule.

"We use two set screws to keep our whip tip in place, rather than just one like the competition," comments Jeff at Wintenna. "We have made a lot of the antennas that are sold under other names," adds Wintenna. The Wintenna dual set screw doesn't require an Allen wrench to adjust—it is a slotted head, which means you have one less adjustment tool to lose in your mobile installation. We liked this. The Wintenna warranty is for a lifetime—a six-month free replacement,

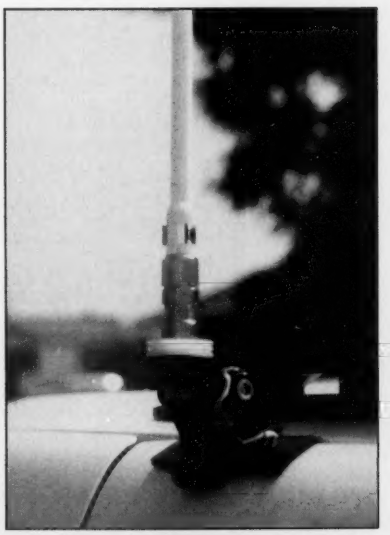

Photo A. The simple hatch mount will hold the lightweight whips on your vehicle.

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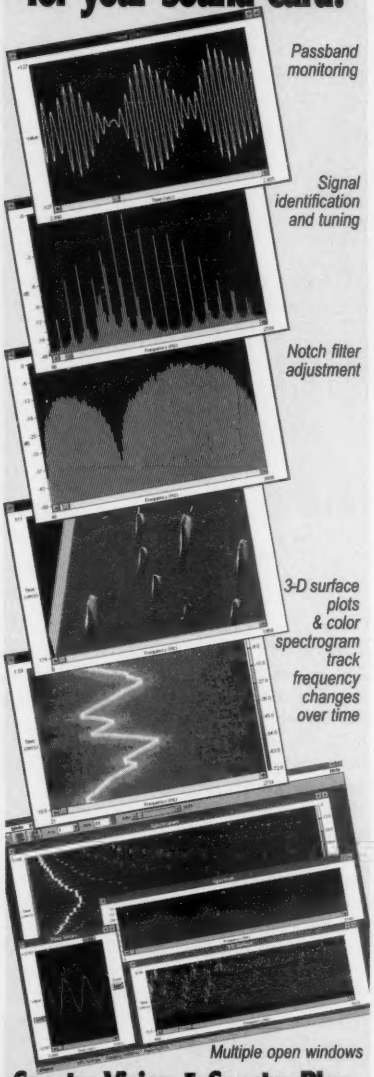
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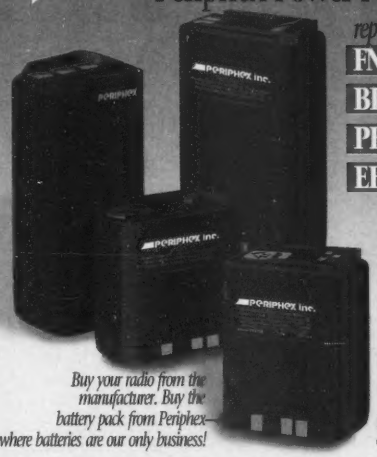

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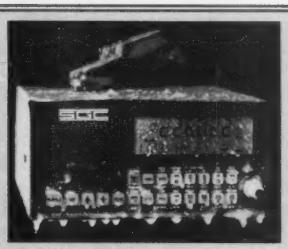
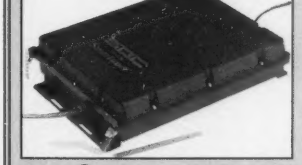
CIRCLE 68 ON READER SERVICE CARD



BUY AMERICAN, BETTER PRICE AND QUALITY

The SG2000 HF transceiver is type accepted for commercial and marine service made with traditional U.S. commercial radio quality (and of course it can be used on the ham bands also). While the Japanese radios have 2 final transistors that strain to put out 100 watts on the low bands and only 75-85 watts on ten meters, the SG2000 has 4 large transistors that loaf along at 150 watts on ALL THE BANDS INCLUDING 10 METERS! Some of the SG2000 features are: 1) A control head remotable (no special kit necessary) up to 150' away from the rig, perfect for automobiles and boats. Up to 8 heads can be utilized and used as intercoms also. 2) The largest display of any HF transceiver. 3) 644 pre-programmed memories and 100 user programmable memories. 4) operable from -50F (-45C) to 185F (+85C). You want quality right? Here is what EVERY SG2000 must endure before they're shipped from the factory: 1) They're factory aligned, 2) EVERY SG2000 is keyed down at full power (CW 150 Watts) into an open antenna for about 10 seconds, then connected to a shorted antenna and keyed down for an additional 10 seconds. 3) EVERY SG2000 is put in the "BURN-IN" rack and keyed down for 24 hours non-stop at full power CW. Don't try that with the foreign radios. 4) EVERY SG2000 is then re-checked for alignment and put in the "TORTURE RACK" where they are keyed on and off every 10 seconds for 24 hours. 5) The SG2000 is then re-evaluated and all control functions are verified to ensure that the microprocessor is up to spec. THEN AND ONLY THEN IS THE SG2000 ALLOWED TO LEAVE THE FACTORY.

The bottom line is price, you know how expensive commercial rigs are normally, we are selling the SG2000 BELOW DEALER COST at only $1,585.00 each!! That's a $400.00 savings! We guarantee the best price.



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CIRCLE 384 ON READER SERVICE CARD

Photo B. A capacity top hat extends the resonant points on a 40 meter antenna, so no tuner *is needed!*

and a 50 percent cost replacement thereafter.

Valor also makes their own HF mobile antennas, and they stress that their 20-gauge copper wire on a 3/8" Fiberglas rod with nickel-chrome-plated brass ferrules is superior to all of the other antennas out in the marketplace.

"The upper whip is 17-7 taper ground, stainless steel, and provides the user the ability to fine-tune the antenna by sliding the whip in a special ferrule until the desired resonant frequency is found," comments Gerry Stephens W8LLW, vice president of engineering at Valor.

"Our antennas are covered by a one-year limited warranty. If someone discovers a manufacturing defect, we will offer full replacement at no cost," adds Stephens. The Valor whips are rated at 250 watts PEP, but I have personally run them at 600 watts and haven't blown one up yet. Yes, the helical center-load gets mighty warm after about three minutes of high-power talking.

The Anttron HF whip seemed well-constructed, with the same gauge of helical windings that the other antennas have. The Anttron whips feature a single screw for securing the stainless steel whip into the shaft, and it takes an Allen wrench (supplied) for this simple adjustment.

The ASA "Fiberwhips" are made by Valor. They feature a screw-in top ferrule for pre-set tuning. In our tests, we found that we could use a single whip tip that would be interchangeable at its pre-set length to all ASA and all Valor whips down to the 40 meter band. On 75 and 80 meters, whip adjustment is an absolute necessity for all brands of whips.

"Our $17.75, less expensive, Fiberwhips have a one-year warranty from date of purchase, and the tapered top screw-in ferrule helps eliminate the problem of water seepage on the inside of the hollow shaft," comments Jim Wood of ASA. "... We suggest a small amount of Coax Seal or silicon flexible sealant for the top whip where it goes into the ferrule for anyone in a heavy wet-weather environment," adds Wood. Good advice—on any of these whips from all manufacturers, a little glob of something where the stainless steel whip goes into the shaft is a great idea.

Center-loading of these whips from all manufacturers—including a lazy helical wind-down to the base—offers good bandwidth at each band:

6 meters	1000 kHz
10 meters	500 kHz
12 meters	300 kHz
15 meters	200 kHz
17 meters	175 kHz
20 meters	150 kHz
30 meters	100 kHz
40 meters	55 kHz
75 meters	33 kHz
160 meters	12 kHz

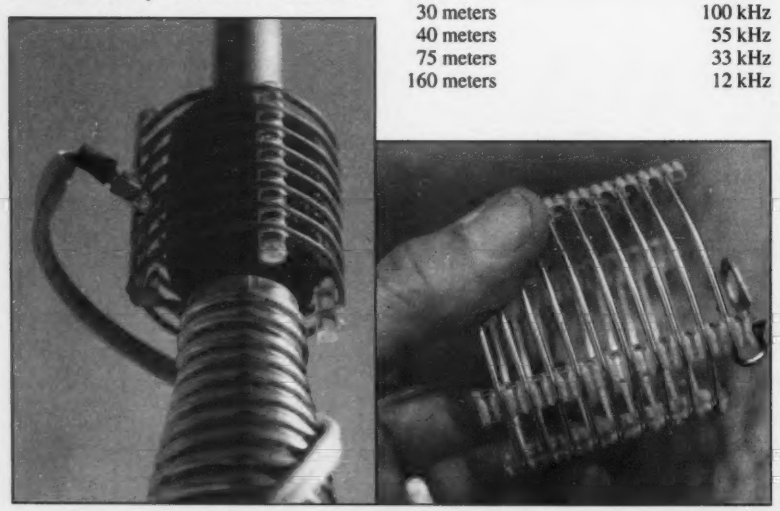

Photo D. It may take a coil to resonate the 75m and 40m whips on some vehicles.

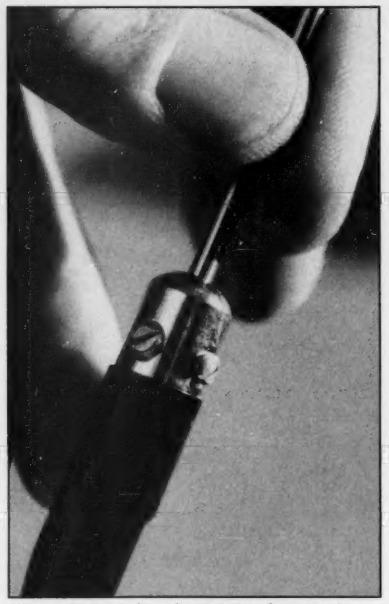

Photo C. Seal this slip-joint to keep moisture from entering the hollow shaft.

We found that where we mounted the whip on our vehicle, 40 meters, 75 meters, and 160 meters made a *major* difference in how low the SWR would dip after fine-tuning the whip tip. In some cases, a disc capacitor in shunt with the feed point assisted in bringing the feed point impedance back up to a target 50 ohms. Valor includes some of these disc capacitors with some of their antennas.

In other cases, it took a coil from Antennas West to give us a better match on the lower bands. Newer transceivers with built-in automatic antenna tuners can also help resolve this mismatch problem between the antenna and feedline and the 50 ohm rig. While the built-in tuner doesn't solve the feed point problem, it will allow your radio to put out more power into a seemingly resonant load. Nothing beats working with an antenna bridge to define a feed point problem and resolving it by either relocating the feed point to another part of your vehicle, or working with coils or capacitors to bring the antenna into resonance.

So if you are looking for a cheap HF whip, take your pick from what is offered by these manufacturers. Some whips come in colors, too. But be sure to ask the seller how long they expect the colored plastic jacket on the outside of the whip will last. Some whips won't make it through the summer exposed to the sun every day. Yet, others may go through several years of hot and freezing before the plastic ultimately begins to crack and peel off. And when that happens, you can either "roll your own" for a re-wrap, or toss it in the trash can and buy another one for under $20. With this type of whip, you get great value at an incredibly low price. 73

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Bearcat® 8500XLT-J

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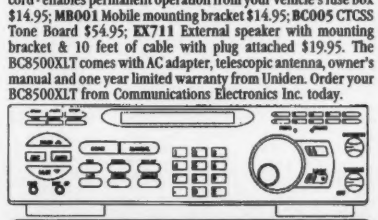

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The Uniden GMR100 is a handheld GMRS UHF 2-way radio transceiver that has these eight frequencies installed: 462.550, 462.725, 462.5875, 462.6125, 462.6375, 462.675, 462.6625 and 462.6875 MHz. This one watt radio comes with flexible rubber antenna, rechargeable ni-cad battery, AC adapter/charger, belt clip, F.C.C. license application and more.

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Mobile-ON Alarm/Timer

This little circuit could save your car's battery.

by James W. Elkins, Jr. KA8PHO

At one time or another, we have all walked away from our cars and trucks with the mobile rig still powered up. I have done this on many occasions. I don't like the thought of draining the battery. I don't like the thought of the radio accidentally transmitting an unidentified signal, either. The latter could tie up a repeater for hours, or until the culprit is discovered. With these thoughts in mind, I decided that it would be nice to have a control system that would remind me that my equipment was still on. An alarm would do nicely, but another thought that crossed my mind was that I occasionally operate mobile during public service events and so I need to be able to use the radio gear when the car is shut off. I decided that a time delay circuit could be incorporated into the control, to bypass the alarm but still shut itself off after a predetermined time.

The circuit that I put to work for myself is shown in Figure 1. I decided to call it the "Mobile-ON Alarm/Timer." It is a simple but effective device, easy-to-assemble and to install with minimum wiring. The completed unit was placed in a Ten-Tec enclosure, painted and labeled to keep its appearance neat in the automobile. Relay K1 is a heavy-duty type used for switching higher current loads. This keeps you from having to run heavy wires to the circuit, so it could be mounted under the hood near the vehicle's battery terminals. You will also notice from looking at the schematic that I color-coded the wiring. This, I thought, would make it easier to trace back any wiring, if the need ever arises. Nothing is more aggravating than opening the hood and finding a massive amount of red and black wires to weed through. Smaller-gauge wiring can be used to run back to the control box; 18 or 20 gauge should work fine.

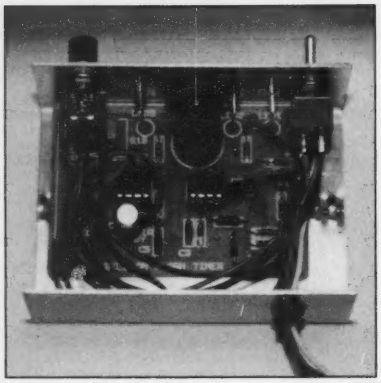

Photo A. A bird's-eye view of the Mobile-ON Alarm/Timer circuitry.

Operation

Three LEDs are mounted through the front of the enclosure. They provide status indications of the circuit. LED 1 will light when the vehicle's ignition is on, or while the car is running. Switch S1 in the ON position will close relay K1, completing the power circuit to the equipment. If the ignition switch is shut off, and switch S1 is still in the ON position, an alarm (piezo) will begin to beep and LED 2 will flash. Returning S1 to the center position will shut everything off. If operation of your equipment is desired after shutting off the vehicle, you can place switch S1 in the AUTO position and momentarily press S2, a normally-open push-button. Depressing this begins a timing cycle. The length of the time period that the Mobile-ON Alarm/Timer operates before shutting everything off can be "programmed" by selecting R6. The approximate time delays are provided in the chart with the Figure 1 schematic. Or, you could instead change C6. These components control the holding time of relay K1. LED3 will light while the circuit is in AUTO status. Incidentally, you can also cancel the time delay at any time during the delay period by simply switching to OFF.

As shown in the Parts List, all of the parts can be easily obtained from your favorite store, catalog supplier, outlet, or surplus parts dealer. The cabinet I used is a Ten-Tec type, number TP-14, but any enclosure that suits your taste will suffice. A small hole was drilled approximately 1/4" to 3/8" in the

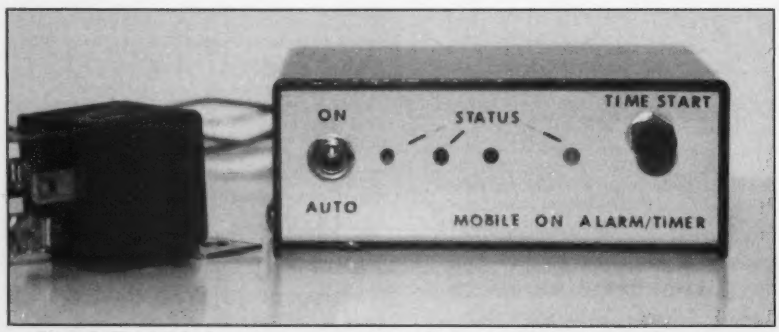

Photo B. The finished unit looks presentable in this painted and labled metal enclosure.

Parts List

Resistors, (1/4 or 1/8 watt)	
R1, R5, R8	1000 ohm
R2, R3	100k ohm
R4	470k ohm
R6	Select for time (see Figure 1)
R7	150 ohm
Capacitors (All capacitors 25 or 50 volt ceramic disc type, except C6, which is electrolytic type, 16 volt.)	
C1, C2, C4, C5	0.1 µF
C3	0.01 µF
C6	100 µF
Semiconductors	
U1, U2	NE555 timer
D1, D2, D3, D4	1N4148 diode
LED 1	Green T1 type
LED 2	Red T1 type
LED 3	Yellow T1 type
Relays	
K1	Radio Shack #275-226 SPST 12 volt, 30 amp (not on PC board)
K2	Radio Shack #275-241 SPDT 12 volt
Piezo alarm	Radio Shack #273-074
Switches	
S1	DPDT center off, toggle, Radio Shack #275-620
S2	Normally open, momentary, Push button type.
Cabinet	Ten-Tec type TP-14 or similar
Color-coded hookup wire	
In-line fuse holder	

Drilled and etched PC boards with component placement silk-screened on them are available from Far Circuits, 18N640 Field Court, Dundee IL 60118 for $3.50 plus $1.50 S&H per order.

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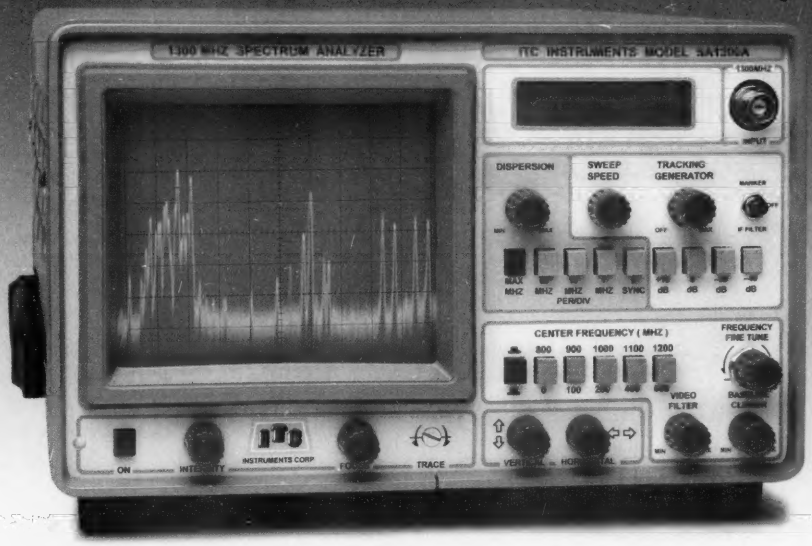

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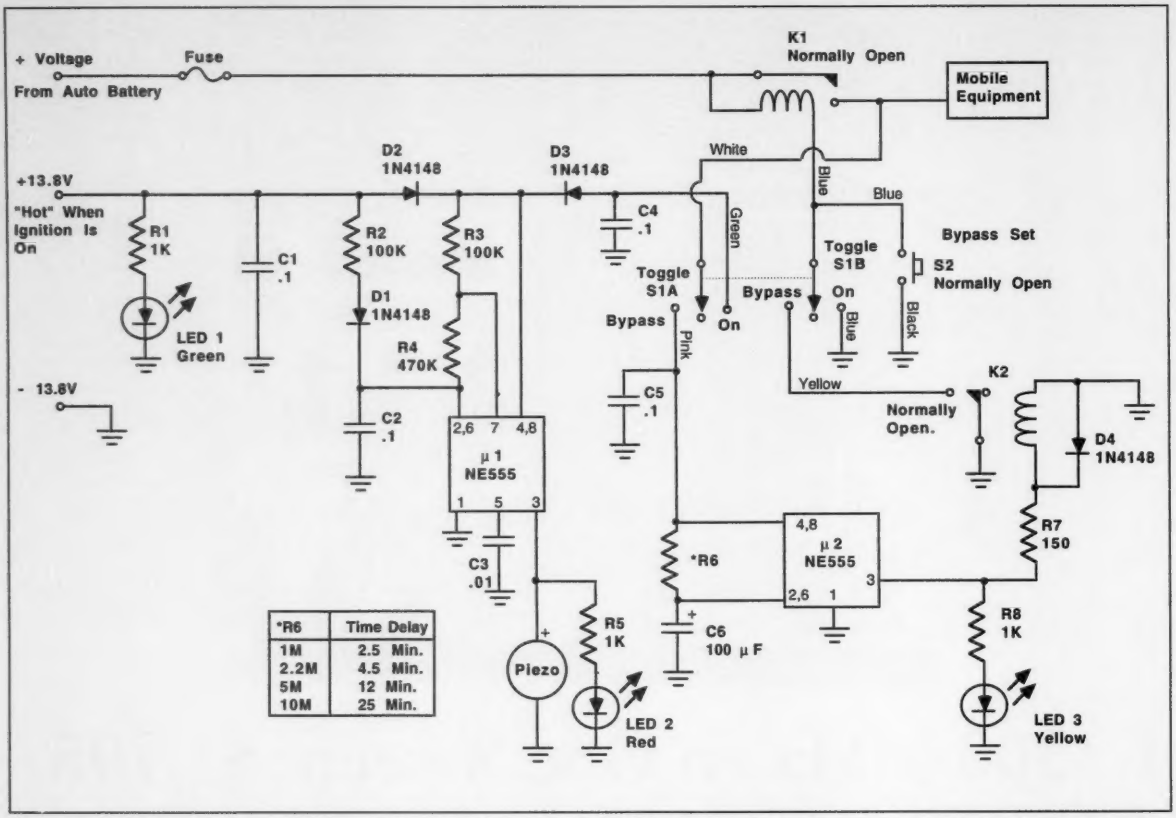

Figure 1. Mobile-ON Alarm/Timer. Notes: 1) K1 and the fuse are not on the printed circuit board; these are located elsewhere in the vehicle. 2) The colors are shown to help reference the wiring to switches, relays, and board.

front to permit the audio tone emitted from the piezo alarm to be heard better. Additionally, a piece of felt or similar material was glued to the inside front panel to keep dust out of the enclosure.

The circuit is probably best assembled on a printed circuit board, but a copper-clad perf board would work also. A PC board etching pattern (Figure 2) is shown, for those of us who have access to making a board, or would like to use one of the popular kits. Alternately, a board with component layout silk-screened on it is available from Far Circuits, 18N640 Field Court, Dun-dee IL 60118 for $3.50 plus $1.50 S&H per order. Location of the components on the PC board is shown in Figure 2.

After assembly is completed, recheck your wiring to the relay and double-check for solder bridges, etc. Be sure that the correct polarity of the electrolytic capacitor is followed, and that the diodes are installed correctly. Also note that a fuse for the + power lead is installed in line to the relay contacts. The fuse should be able to handle just slightly more than your equipment draws. Most equipment is fused in the factory-supplied power leads, but adding a main fuse can help here in case of a short near the relay.

I believe that after installing the Mobile-ON Alarm/Timer in your car you will enjoy its operation, and be satisfied knowing that you will not forget to turn off the power to your equipment. And, even if you leave it on in the AUTO position, it will shut everything off for you in a matter of minutes.

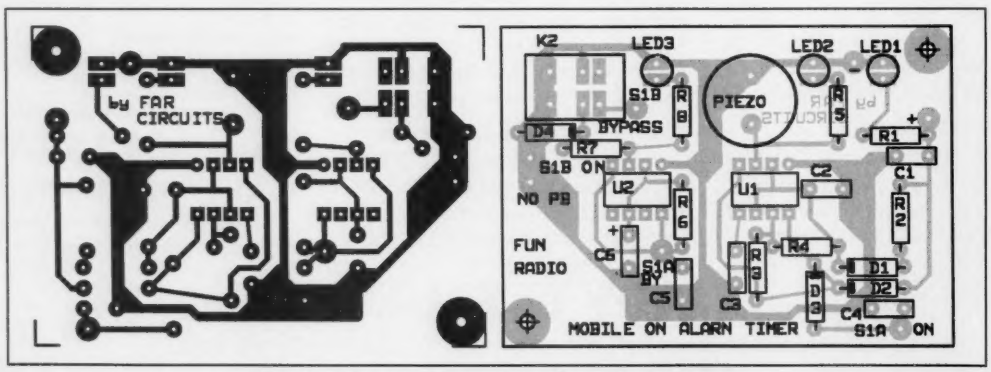

Figure 2. PC board etching pattern and component placement.

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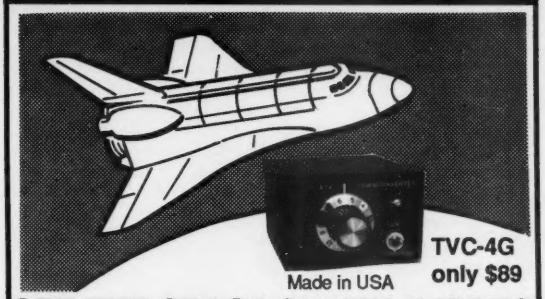

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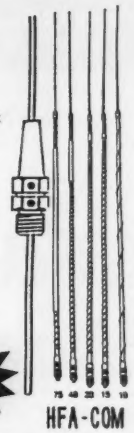

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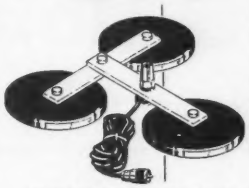

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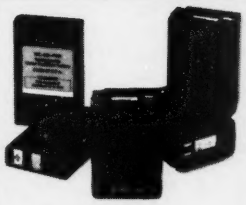

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All three are extremely sturdy antennas, and are available in several base configurations, including the popular "NMO"-style mount, which all three review antennas used.

The POWER-MAX 18-300

This antenna is your basic, garden-variety 5/8-wavelength whip, similar to the popular Larsen model. As shipped, the element measures about 54", and you'll have to cut it to the correct length before installation. This can take a bit of effort as the element is made of 17-7 stainless steel! The recommended procedure is to measure the desired cut location, then score the whip with a saw, file or grinding wheel. The excess can then be snapped off by bending it with a good-sized pair of pliers.

Midland provides a cutting chart which gives rod lengths all the way from 138 MHz to 174 MHz. For 146.000 MHz the optimum length is 49.02", so I cut it to exactly 49" and let it go at that. The rod is *extremely* stiff—much heavier than a comparable Larsen whip. In fact, my overall impression of the 18-300 is its sturdiness and weight—this is not a cheaply-built mobile antenna. (Photo A shows the magnetic mount and coil assembly.)

An Allen wrench is provided to fasten the whip into the coil assembly, which in turn screws onto the magnetic base. Having done this, I decided to run a series of measurements using a Bird Model 43 wattmeter and the roof of my car to check VSWR across the entire 4 MHz of 2 meters (Table 1). Oddly enough, I saw the best match towards the lower end of the band, indicating that the rod could have used a bit more "clipping!" However, since the overall SWR was under 1.6:1 at 148.000 MHz, I didn't bother.

Received signal reports and usable range with my Kenwood TM-221 correspond closely to my existing setup, a Larsen KulRod 5/8" whip and coil. The two antennas are interchangeable, but the biggest difference is the increased weight and sturdiness of the Midland whip. The most critical test I can put an antenna through is the "garage door springback," and while I've bent quite a few Larsen whips pulling into and backing out of the garage, the 18-300 whip is so strong it actually pops the magnetic mount loose and topples over! According to John Chass WØJLC, Vice President of Marketing for Midland, this is the heaviest mobile whip on the market today and it has considerable "spring" to it, so *be careful* when you bend it for any reason

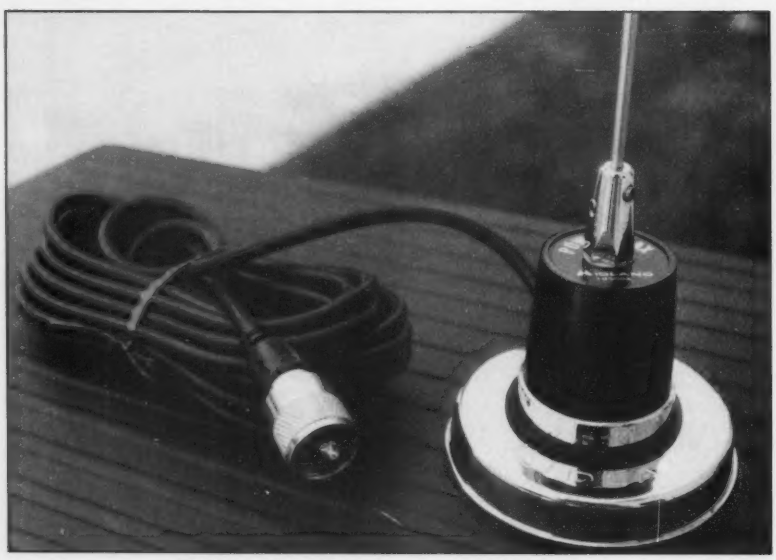

Photo A. The 18-300 5/8 wave mag mount and whip.

Frequency	Measured VSWR
144.000	1.1:1
144.500	1.1:1
145.000	1.1:1
145.500	1.15:1
146.000	1.175:1
146.500	1.2:1
147.000	1.4:1
147.500	1.5:1
148.000	1.6:1

Table 1. 18-300: VSWR vs. frequency.

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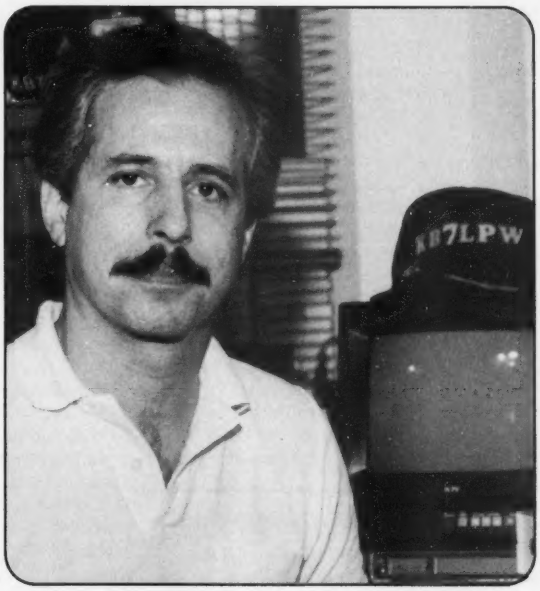

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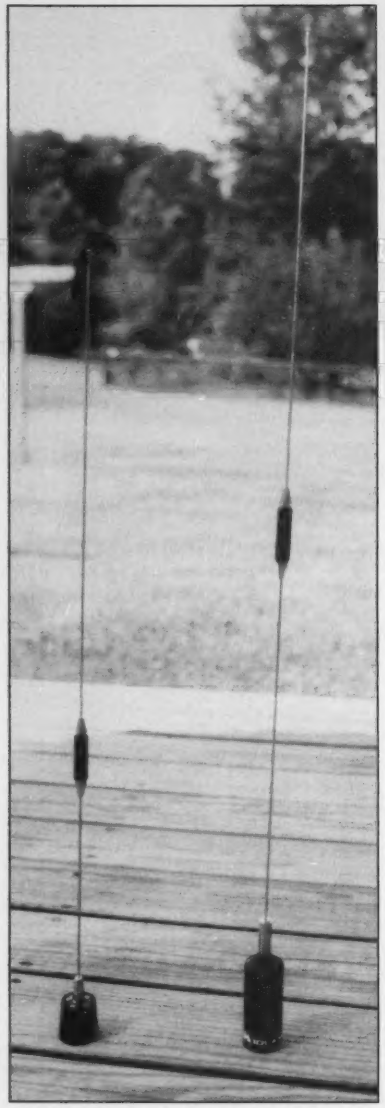

Photo B. The 18-330B (left) and the 18-325 (right).

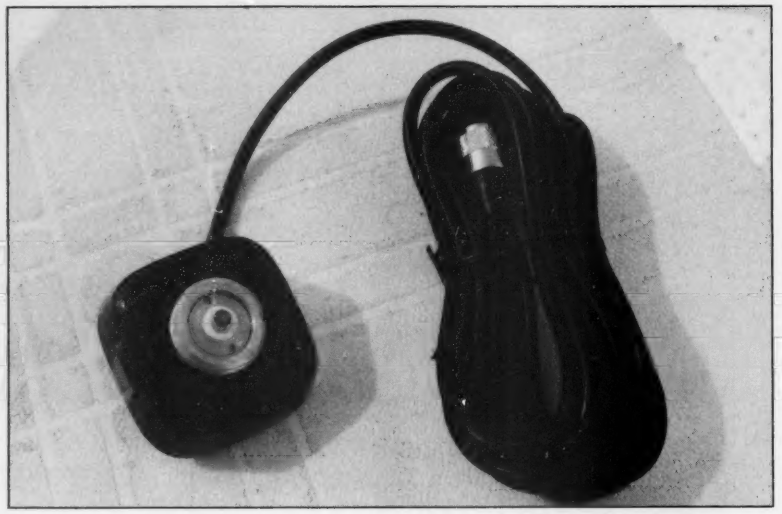

Photo C. The 18-316 trunk mount.

as you can get a nasty "whack" on the head, or elsewhere on your body!

The 18-330B 70cm Antenna

For the 70cm enthusiast, Midland has brought out a 5 dB collinear antenna which utilizes the same NMO mount as the 18-300. Again, 17-7 stainless has been used for both whip sections and you'll need to score the antenna before cutting it to the proper length. Photo B shows the relative size of the 18-330B and its dual-band cousin, the 18-325.

There are actually three versions of the 18-330, and the "B" option is specified to cover the frequency range 445-475 MHz. It might seem a bit odd to leave off the lower 5 MHz of this band segment, but in reality the measured VSWR is low enough with one cut to obtain 10 MHz worth of coverage (see Table 2). Using the supplied chart, I cut the lower rod as suggested to 7-7/8" inches, then watched it roll off my outdoor dining table and disappear through a crack in my deck!

After much cussing, swearing and "fishing," I retrieved the missing rod and completed assembly of the antenna. The moral of the story: Leave either the bottom coupling nut or the coil attached when cutting the rod so you don't feel as foolish as I did! With a Yaesu FT-790RII and Bird 43, I took measurements across the band and found the worst-case SWR to be 1.8:1 at 440 MHz, dropping to 1.4:1 from 444 to 450 MHz. I probably cut the rod just a bit too short, but 1.8:1 only amounts to 9% reflected power and the Yaesu was quite happy. I suggest starting at 8" and working down from there to get the best match.

". . .this is the heaviest mobile whip on the market today and it has considerable 'spring' to it, so be careful when you bend it for any reason as you can get a nasty 'whack' on the head, or elsewhere on your body!"

The 18-325 Dual-Band Antenna

For those of us who can't decide between these two antennas, Midland has introduced the 18-325 dual-band mobile whip, again constructed of this incredibly strong 17-7 stainless material. It is also available in the popular NMO configuration and, unlike its relatives, requires no adjustments whatsoever. (This means no more trips under the deck!)

The 18-325 is another "stacked" configuration: It works as a 5/8-wave antenna from 144-148 MHz with 2.4 dB nominal gain, while from 440-450 MHz it behaves in a collinear fashion with 4 dB nominal gain. (For those not familiar with the term "collinear," it is used to describe a design where two or more radiating elements are fed in series to achieve a lower angle of radiation and increased gain in the horizontal plane.)

Out of the box, the 18-325 exhibits a fairly broad SWR curve on both bands, measuring 1.7:1 at 440 MHz and 1.4:1 at 450 MHz (see Table 3.) The dip is fairly shallow, so the antenna can be said to be "broad-banded." On 2 meters, the results are not quite as good, starting at about 1.9:1 at 144 MHz and dropping to 1.25:1 at 148 MHz. However, these results are quite acceptable on both bands. For the most part, I don't fret much with matches below 2:1 at these frequencies, as this amounts to about 11% reflected power. Today's mobile radios can handle this with ease.

Both the 18-330B and 18-325 perform well in over-the-air tests, although the 18-330B seems to be just a tad better, as you might expect for a single-band antenna. Although I only ran 25 watts power on 70cm, both antennas are capable of handling in excess of 200 watts. On-the-air signal reports were excellent (primarily on simplex), and both antennas behaved similarly while driving through hilly terrain. Most importantly, both survived the "garage door jam" test with flying colors. These antennas will certainly hold up over the long term! (Now, if this bump on my head would just go away . . .)

Other Observations

All three antennas employ a base loading/matching coil which is encased in Lexan, the same stuff they make football helmets out of. All finger contacts are gold-plated to ensure

Frequency	Measured VSWR
440.000	1.9:1
441.000	1.7:1
442.000	1.5:1
443.000	1.2:1
444.000	1.15:1
445.000	1.1:1
446.000	1.15:1
447.000	1.2:1
448.000	1.4:1
449.000	1.4:1
450.000	1.4:1

Table 2. The 18-300B: VSWR vs. frequency.

Frequency	Measured VSWR	Frequency	Measured VSWR
144.000	2:1	440.000	1.75:1
144.500	2:1	441.000	1.75:1
145.000	1.8:1	442.000	1.6:1
145.500	1.7:1	443.000	1.55:1
146.000	1.65:1	444.000	1.5:1
146.500	1.5:1	445.000	1.5:1
147.000	1.4:1	446.000	1.5:1
147.500	1.3:1	447.000	1.5:1
148.000	1.2:1	448.000	1.6:1
		449.000	1.6:1
		450.000	1.6:1

Table 3. The 18-325: VSWR vs. frequency (144/440 MHz).

low-resistance junctions, and the internal coils are silver-plated. Additionally, the top ferrulle nut is made from brass, with three layers of stainless plating. Add in the 17-7 stainless whips and you have a *very* durable antenna!

All three Midland antennas are designed to work with one of three different mounts: The 18-316 trunk mount (Photo C), 18-312 roof mount (not reviewed), or the 18-318 magnetic mount supplied with the 18-300 2 meter antenna. The 18-300 5/8-wave 2m gain antenna retails for $59.95 (including the magnetic mount), while the 18-330B sells for $29.95 and the dual-band 18-325 comes in at $49.95. The 18-318 magnetic mount is available separately for $32.95, while the 18-316 trunk mount can be yours for $24.95.

Don't forget to place your ad in the *73 Amateur Radio Today* Barter 'n' Buy section. See page 81 for details.

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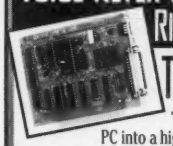

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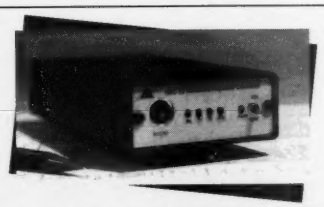

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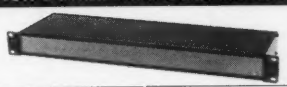

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CIRCLE 167 ON READER SERVICE CARD

73 Review

Number 10 on your Feedback card

by Donald E. Koehler N7MGT

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Madison WI 53744-4960
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Price Class: Four-pack of AA cells—$5.99; Power station for four AA cells—$15;
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The Rayovac Renewal Battery

A ham's dream cell.

If I could just find something cheaper than NiCds, some kind of battery that is rechargeable and has a good power density. Maybe Molicells or something more exotic, perhaps a Zinc-Oxygen cell pack or Nickel Metal Hydride battery.

What is a ham to do for real portable power? Now the folks at Rayovac have answered my needs with a new rechargeable alkaline battery: the Renewal cell.

Based on technology purchased from a Canadian company and then refined by Rayovac, the Renewal battery is one of the hottest new batteries to hit the market in years. Why? Because it offers power density every bit as good as that of conventional alkaline batteries, at a reasonable cost, and with none of the quirks of NiCd batteries. It even boasts several "green" features, such as almost no mercury content and no cadmium at all. A claimed shelf life of five years, coupled with the ability to be recharged, make a sure bet that this battery is going to be a hit with portable radio users everywhere. Even better, it's sure to be a hit with serious ham operators as well. I've tested the battery and I'm sold on it. Let me share my test results with you.

Test Results

Since the battery-powered portable equipment you use and how you use it will be different for everybody, how could I test a battery for performance? After some thought, I designed a performance test for comparing different types of batteries. While the test may not directly relate to any specific piece of equipment, it does allow for a straight one-to-one performance comparison under controlled conditions. The test also has the advantage of being easy to repeat. The battery under test, in this case (a single AA battery), is hooked to a constant current "sink." In this test the current sink is a common flashlight bulb. It will draw an almost steady current under varying voltage conditions. In other words, as the battery drains, the voltage drops but the current draw due to circuit resistance in the test "loop" remains essentially the same. The voltage and current in the circuit were monitored and the results recorded. Test cell voltage was monitored by a digital voltmeter, the current by a precision Fluke Model 8000 milliammeter. The resulting data points were recorded and are displayed in Figures 1 and 2. Please note the overall

Continued on page 42

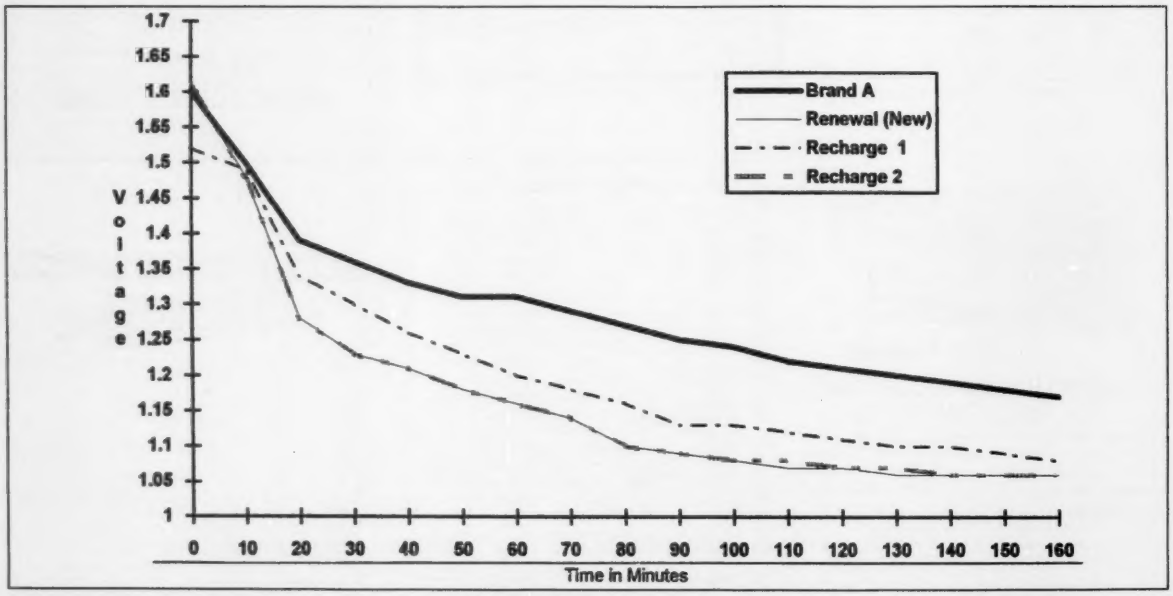

Figure 1. Voltage vs. time curve.

Number 11 on your Feedback card

UPDATES

"Using the World's Most Accurate Frequency Standard, Part 3."

Refer to the above mentioned article in the March 1994 issue, page 18. In the Figure 1 schematic, add C13 (a 0.01 µF cap) between +8V and GND. On the Figure 2 schematic, LED2 and LED3 are shown with reverse polarity.

"ASCII-to-Morse Code Interface"

Refer to the above mentioned article in the February 1994 issue, page 36. An updated version of the program code is available on the *73* BBS: (603) 924-9343. (No change is necessary if you ordered the data disk from the author.) Pins 2 and 3 on the DB-9 Jack J3 are shown swapped; pin 2 goes to "T" and pin 3 goes to "R," as marked on the board. One side of the S3 "KYR SPD" switch should go to ground, not +5V, as shown on the PCB parts placement overlay. Simply run a wire from the switch to an unused ground pad instead.

Number 12 on your Feedback card

HAM HELP

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2"x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

NEEDED: Service manual for the ALINCO ALD-24T mobile transceiver. I will gladly pay the photocopy and shipping cost. Thanks. *Jacques Brodeur VE2EMM, 5034 Joseph Rodier, Montreal Que. H1K 5E1 Canada.*

I need a schematic for SHAKESPEARE GBS 5000 (CB), or info to convert to 10 meters. I will pay for copies and postage. *S. Brzoska N2MHQ, 27 Willow St., Washington NJ 07882.*

WANTED: Service manual/schematic, for JFD Model 7200 Field Strength Meter. *Marvin Moss, Box 28601, Atlanta GA 30358.*

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CIRCLE 30 ON READER SERVICE CARD

The Rayovac Renewal Battery *Continued from page 40*

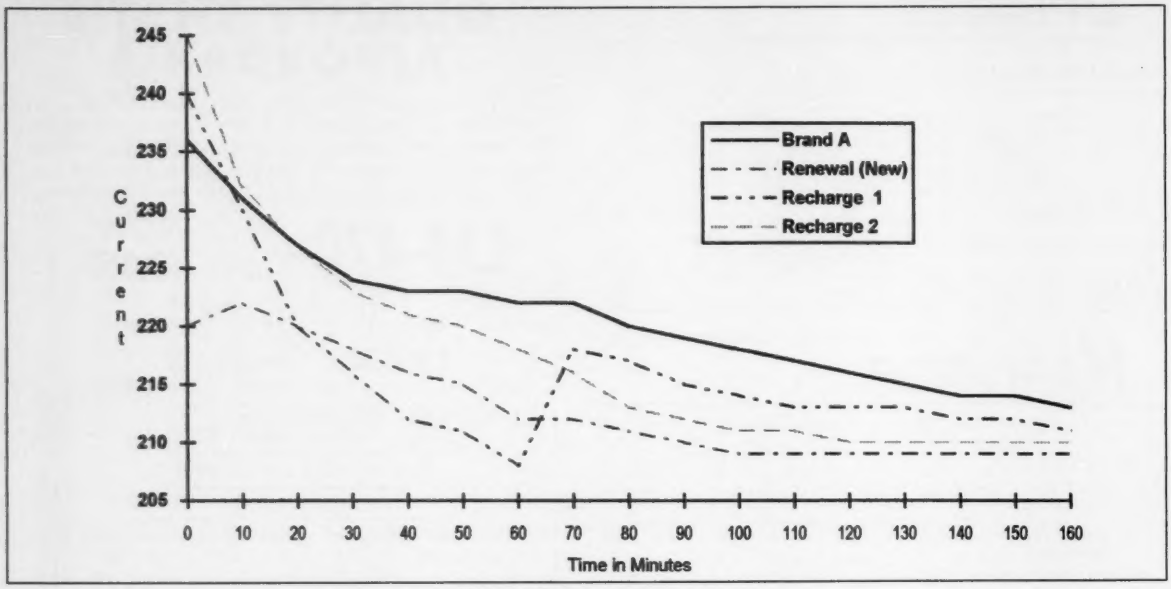

Figure 2. Current vs. time curve.

shape of the performance curves and not the absolute values.

Brand A is actually a compendium of values obtained from several test runs using two different brands of conventional alkaline batteries. The Renewal battery was run through the test new from the package, recharged overnight in a Rayovac Power Station, then tested in this charge/discharge cycle again and again. After several charge-discharge cycles, the test results for the Renewal battery remained essentially the same. The only

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Equipment	Voltage	Current Draw	Conditions
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Shortwave RX		33 mA	W/headphones
Sony 2002	6.0 VDC	60 mA	W/O headphones
Shortwave RX		53 mA	W/headphones
ICOM IC-2AT	9.0 VDC	45 mA	RX squelch off
VHF FM transceiver		265 mA	TX hi pwr.
PRO-38 scanner	7.5 VDC	75 mA	SQ off
Wideband scanner		42 mA	RX normal

Table 1.

anomaly in this series was during the test after the first recharge, when a current spike showed at about an hour into the test. It never occurred again. The data sets obtained from testing multiple Renewal cells are otherwise unremarkable. The Renewal curves compare favorably with the conventional cell.

Table 1 shows some common electronics equipment useful in emergency situations and the amount of current used by that equipment. You may infer performance of the Renewal battery in portable equipment by comparing current draw to test results. In these tests, the Renewal battery produced significant amounts of current (210 mA) even after over two-and-a-half hours of steady draw. The smaller of the two shortwave sets listed in Table 1 only uses 15% of the test current in normal operation. Over 20 hours of full-time operation would still leave the battery with more than 1 volt remaining. When I talked to the folks at Rayovac, one of the technical staff suggested that 1.0 volt would be good as a bench mark for recharging; however, the battery could be run totally "flat" without damage. I drained one cell until no voltage was indicated, then recharged it overnight. It then indicated 1.61 VDC. No damage! This isn't a recommended practice, but if you do it occasionally it won't ruin the battery.

Observations: Renewal batteries exhibit the same performance curve as conventional alkaline cells but their absolute values are somewhat lower. Performance of the Renewal clearly exceeds NiCd cells in the same working environment. The failings (rapid current drop-off, memory effect) of NiCd cells have been amply documented so I won't repeat all of them here. A shelf life at 85% of full charge of over five years and a power density of 1.7 Ah for AA cells is claimed, and I have every reason to believe it.

When a cell recharge is needed, you *must* use the Power Station recharger. This recharger station from Rayovac comes in two flavors: a compact four-cell version for AAA and AA cells and an eight-cell "family" station which can handle AAA to D cells. Both run from 117V AC mains and recharge the cells with a proprietary pulse-current circuit. No provision, as yet, has been made for a 12 VDC charging adapter. A small 200 watt inverter to drive the Power Station would fill the bill for emergency needs until such a time that Rayovac might offer a 12 VDC vehicle charger. *Caution: If your equipment is set up to recharge cells when running from AC mains, remove the Renewal batteries and charge them in the correct charger.* This will save both the cells and your equipment.

The bottom line: The battery pays for itself after the second recharge. Or (using local Anchorage prices) over a mere 25 recharges I can save over $20—per cell! The gravy: There's less in the local waste stream and when the battery does hit the dump—very little hazardous material. I have changed out the batteries in all of my portable equipment and look forward to the savings. So can you! 73

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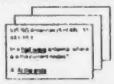

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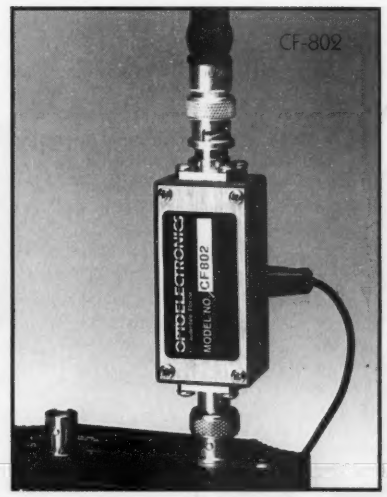

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OPTOELECTRONICS

CIRCLE 172 ON READER SERVICE CARD

The Morse Messenger

A tiny, inexpensive CW IDer for foxhunters, balloonists, and tight-fisted hams.

by Scott Edwards KF7VS

Full-featured CW-ID units are great for repeaters and pampered personal radios, but transmitter hunters, balloonists, model rocketeers, and financially challenged hams need a Morse source that is lightweight, rugged, and as close to free as possible. That's the premise behind my Morse Messenger, a CW-ID unit on a chip.

The Morse messenger, though Spartan in design, offers the following features:

•Keying speeds from 7 to 40 wpm, with Farnsworth-style spacing.

•Up to eight messages in permanent read-only memory (ROM).

•Low power consumption—less than 1 mA when idle, about 3 mA while keying (depending on external loads).

•Direct speaker or piezo transducer drive.

•Ability to turn on an oscillator a half second before keying begins to allow it to stabilize, then turn it off after keying is done.

•Low parts count; the chip, two resistors, and a capacitor make a working circuit.

Of course, the chip has its limitations. Its maximum capacity is 92 characters for the total of all eight message slots. The chip can hold one 92-character message, two of 46, etc. Once messages are programmed, they're permanent; callsign changes mean replacing the chip. And the sidetone output is square wave, not sine wave, so it shouldn't be used to modulate a transmitter without thorough filtering or an external sine wave oscillator, as shown in Figure 4. If you can overlook those small faults, you can construct a working CW IDer for less than $15.

How It Works

Figure 1 shows a simple implementation of the Morse Messenger. The IC is a programmed PIC 16C54 microcontroller. The PIC microcontroller is similar to a microprocessor in that it can perform simple computations, comparisons, and logical operations under the direction of a program. But it lacks the data, address, and control busses that a microprocessor uses to manage lots of memory and peripherals. Instead, PICs and microcontrollers in general have input/output (I/O) ports that allow them to sense levels and switch small loads.

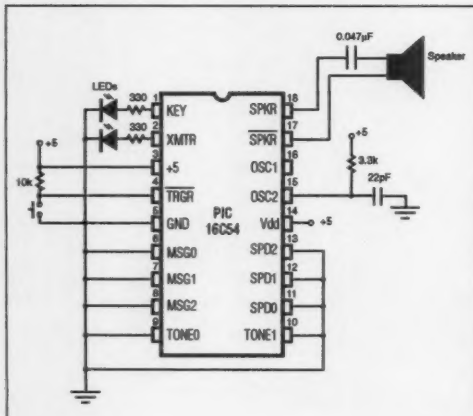
The PIC is different from common microcontrollers in that it is *fast, simple,* and *cheap*. *Fast* means five million instructions per second at the highest clock speed of 20 MHz. To reduce power consumption, the Messenger runs at about 4 MHz. *Simple* means that the chip is a reduced instruction set computer (RISC) device. It is optimized for common operations (such as moving data or comparing two values), and doesn't support some obscure operations at all. *Cheap* means that mail-order dealers carry unprogrammed PIC 16C54s for about $6. The low price is due in part to the fact that these chips cannot be erased. The window that allows erasure with ultraviolet light is apparently a significant part of the cost of making chips; an erasable PIC 16C54 is about $16.

Figure 2 outlines the program that turns a garden-variety PIC into a Morse Messenger. The nut of the program is the method for storing the Morse characters as single bytes of data, and the routine for decoding these bytes.

The basic encoding scheme is simple. The lower three bits of a byte represent the number of elements (dits and dahs) in the character. Three bits can express the numbers 0 through 7, and since the Morse characters of interest have between one and six elements, that's a good fit. The upper five bits represent the pattern of dits and dahs. A 0 is a dit and a 1 is a dah.

The letter F (dididahdit) encodes as 0010x100. The value of bit x doesn't matter, because the lower three bits stipulate that this character has four (100 binary) elements.

Things become stickier with six-element characters. Only five bits are available to stand for individual dits and dahs, so we have to borrow some excess capacity from the lower three bits. If the lower three bits total six (110 binary), the program interprets the byte as a six-element character ending in dit. If the lower three bits total seven (111 binary), it's still a six-element



Set up as shown, the chip will play message no. 0 at 7 words per minute, lowest sidetone frequency (400 Hz). LEDs indicate oscillator warmup (XMTR) and keying (KEY).

MSG2	MSG1	MSG0	Message No.
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

TONE1	TONE0	Sidetone (Hz)
0	0	400
0	1	525
1	0	650
1	1	775

SPD2	SPD1	SPD0	Speed (WPM)
0	0	0	7
0	0	1	10
0	1	0	15
0	1	1	20
1	0	0	25
1	0	1	30
1	1	0	35
1	1	1	40

Figure 1. Simple hook-up diagram for the Morse Messenger chip. The table indicates the range of messages, sidetones, and keying speeds.

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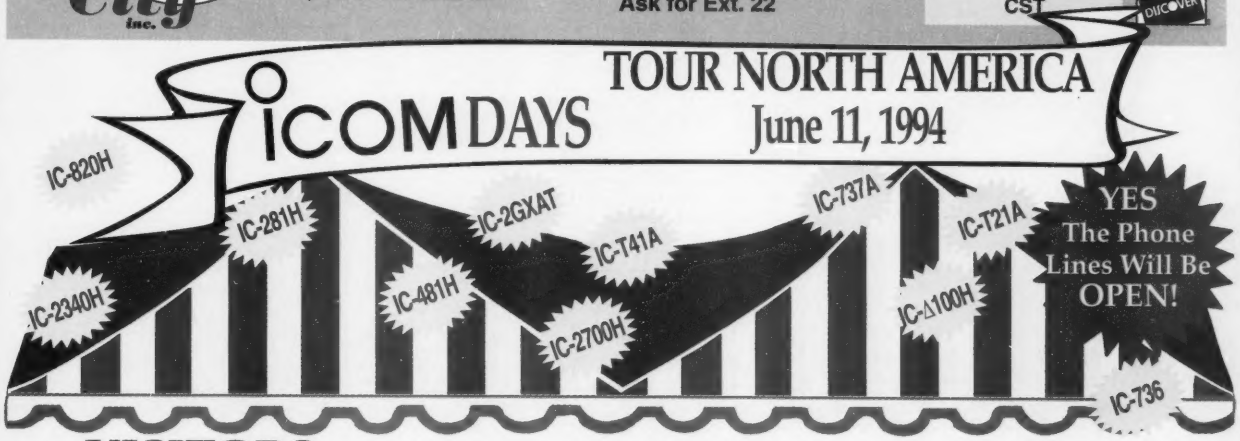

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CIRCLE 153 ON READER SERVICE CARD

character, but ends in dah.

The accompanying table shows how numbers, letters, and punctuation are stored in the PIC's ROM according to their ASCII values. This is a convenient arrangement, since messages are stored as ASCII strings. When the chip keys a message, it looks up the first ASCII character, matches it to a Morse pattern, sends the corresponding dits and dahs, and proceeds to the next message character until the message is complete.

Now that we've looked at the internal details of the chip, let's see how this translates to a black-box view. According to Figure 1, if you tie all of the message, sidetone and speed lines to ground, you are asking the chip to send message number 0 (of 0 through 7) at 7 wpm with a sidetone of about 400 Hz. Connect a small speaker to the SPKR output and LEDs to the XMTR and KEY outputs as shown in Figure 1. Apply power, then press and release the switch. Immediately after you release the switch, the XMTR LED lights. About 0.5 seconds later, the KEY LED begins flashing in time to message 0, while the speaker sings along. As soon as the message is finished, the speaker falls silent and both LEDs go out.

In a real application, XMTR energizes an oscillator and allows it to stabilize for a half second before transmission begins. When the transmission is over, the oscillator shuts down to conserve power. If the oscillator draws 20 mA or less, the XMTR pin can power it directly. This feature is aimed squarely at flea-power uses like foxhunt beacons.

To play other messages, connect the appropriate pins to +5 and ground. For example, Figure 1 says message 6 is 110, so connect pins 8 and 7 to +5, and ground pin

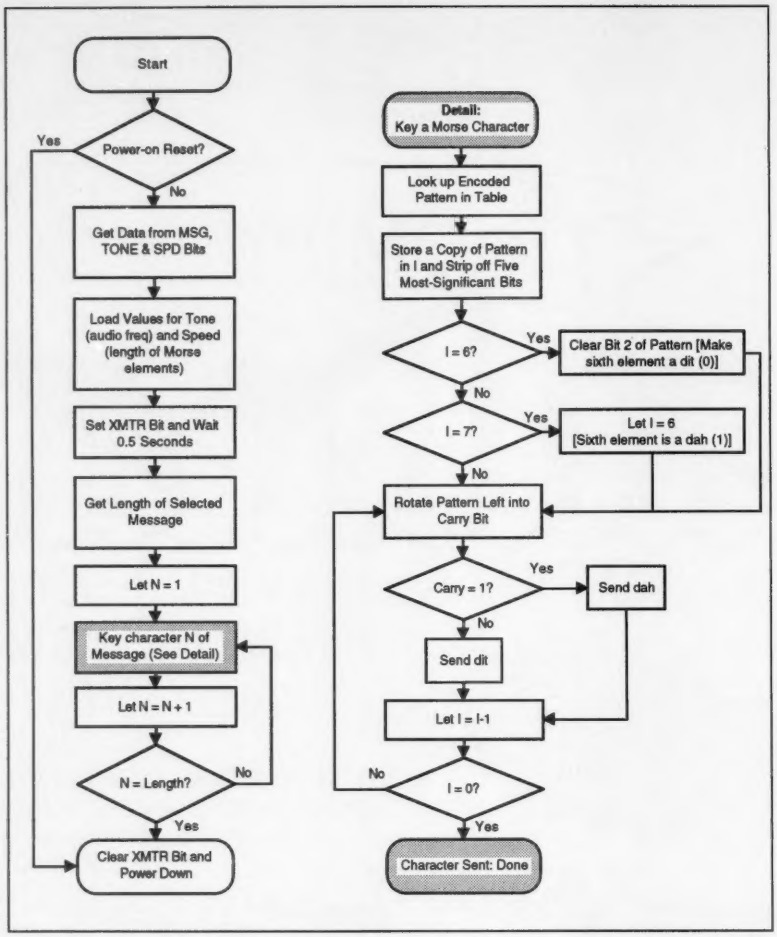
Start
Power-on Reset?
Yes
No
Get Data from MSG, TONE & SPD Bits
Load Values for Tone (audio freq) and Speed (length of Morse elements)
Set XMTR Bit and Wait 0.5 Seconds
Get Length of Selected Message
Let N = 1
Key character N of Message (See Detail)
Let N = N + 1
N = Length?
No
Yes
Clear XMTR Bit and Power Down
Detail: Key a Morse Character
Look up Encoded Pattern in Table
Store a Copy of Pattern in I and Strip off Five Most-Significant Bits
I = 6?
Yes
Clear Bit 2 of Pattern [Make sixth element a dit (0)]
No
I = 7?
Yes
Let I = 6 [Sixth element is a dah (1)]
No
Rotate Pattern Left into Carry Bit
Carry = 1?
Yes
Send dah
No
Send dit
Let I = I-1
No
I = 0?
Yes
Character Sent: Done

Figure 2. Logic of the Morse Messenger's program. This algorithm can be adapted to other devices with the help of the Morse encoding table.

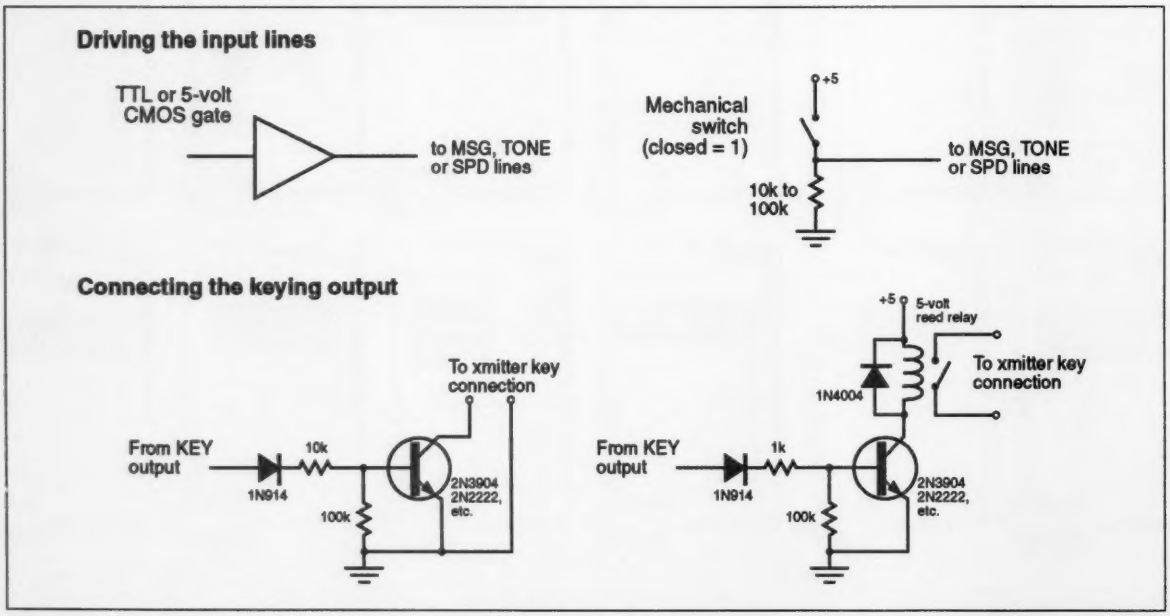

Figure 3. Suggested input and output connections for the Morse chip.

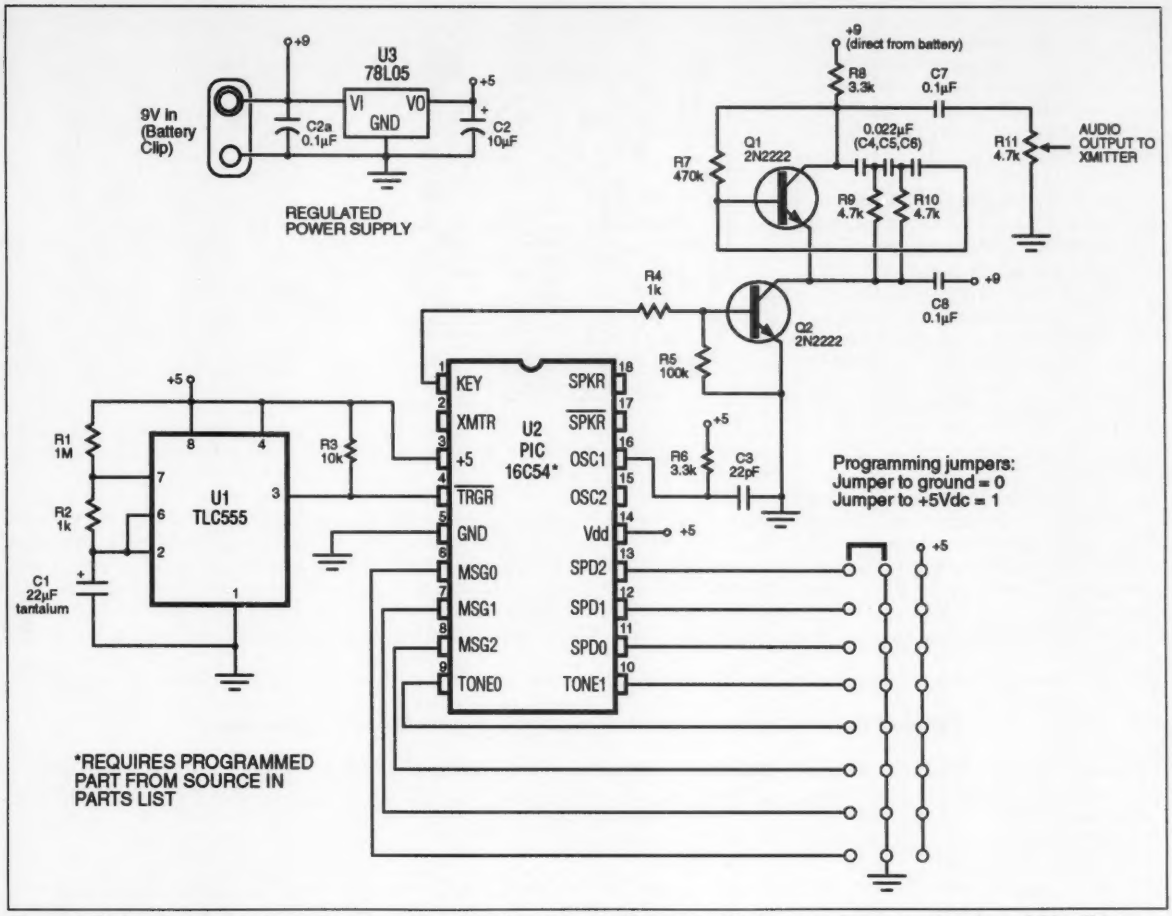

Figure 4. Foxhunt keyer with sine audio output. It sends its beacon every 15 seconds with the parts shown. Larger values of C1 will increase the interval between messages.

Parts List for Figure 4, The Morse Messenger Fox Modulator

Semiconductors		
U1	TLC 555 CMOS Timer	Radio Shack 276-1718
U2	Programmed PIC 16C54	See Note for source
U3	78L05 100 mA, 5 volt positive regulator	Digi-Key AN78L05
Q1,Q2	2N2222 (or similar) NPN transistor	Radio Shack 276-2009
Resistors (All are 1/8W, 5%, unless otherwise noted.)		
R1	1,000,000 ohms	
R2,R4	1,000 ohms	
R3	10,000 ohms	
R5	100,000 ohms	
R6,R8	3.300 ohms	
R7	470,000 ohms	
R9,R10	4,700 ohms	
R11	4,700 ohm trimpot	Radio Shack 271-281
Capacitors		
C1	22 µF 15 WVDC tantalum	
C2	10 µF 15 WVDC tantalum	
C3	22 pF ceramic disc	
C4,C5,C6	0.022 µF ceramic disc	
C2a,C7,C8	0.1 µF ceramic disc	

Note: The programmed PIC 16C54 is available from Scott Edwards KF7VS, 964 Cactus Wren Lane, Sierra Vista AZ 85635. Send $12 check or money order and your typed or neatly printed list of eight messages. Be sure that the total number of characters, including spaces, does not exceed 92. A circuit board for the foxhunt modulator is also available for $5.

For more information on PICs and inexpensive tools for programming them, contact Parallax, Inc., 3805 Atherton Road No. 102, Rocklin CA 95765; Telephone: (916) 624-8333.

6. The same goes for changing sidetones and speeds. Note that you don't have to connect any of these pins directly to the power rails as shown. You can also connect them to +5 volts or ground through fairly large resistors (up to 100k), or tie them to the outputs of logic gates shown in Figure 3.

Figure 4 is a complete audio keying circuit for a foxhunt transmitter modulator based on the Morse Messenger. The circuit is designed to operate from a standard 9 volt battery. With the parts values shown, it transmits a brief message every 15 seconds.

The message, tone, and speed are programmed by installing jumpers between the pins of U2 and ground (0) or +5 volts (1). If you need the ability to reprogram the unit in the field, substitute header stakes for the jumpers and use shorting blocks to make the connections.

As for the rest of the circuit, transistor Q1, capacitors C4 through 6, and resistors R7 through 10 comprise a sine wave oscillator for tone-modulated Morse. Transistor Q2 serves as a switch, while C8 filters key clicks.

Other hams are hard at work on their own applications for the Messenger chip. Steve Jackson KZ1X plans to incorporate it into a foxhunt transmitter, an auto-IDer for HF operation, and the University of North Carolina bicentennial special events station as a beacon. Tom Brown KJ5IE is building it into an off-air tune-up keyer, a "lowfer" (160 to 190 kHz experimenter band) beacon, a U.S.-to-Australia propagation beacon, and for some future moonbounce experiments. I'm sure you can think of a few uses for this cheap, versatile Morse source too.

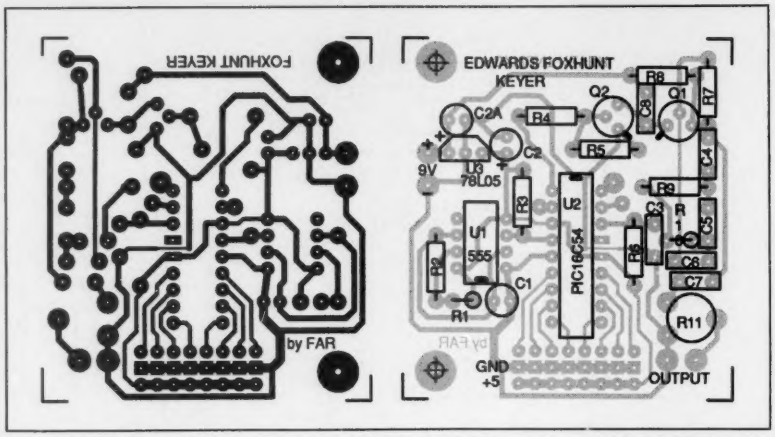

Figure 5. The Morse Messenger Foxhunt Modulator PC board is available for $5 from the author.

Table of ASCII Characters with Morse and Binary Morse Equivalents

Character	ASCII	Morse	Binary Encoding	Decimal Encoding	Remarks
<space>	32		00000000	0	7 dits of silence
!	33		00000000	0	sent as <space>
"	34	•–••–•	01001110	78	
#	35	•••–•–	00010111	23	Morse $\overline{SK}$
%	36	•••–••–	00000000	0	sent as <space>
$	37		00000000	0	sent as <space>
&	38		110011111	207	sent as comma
'	39	•––––•	01111110	126	
(	40	–•––•	10110101	181	
)	41	–•––•–	10110111	183	
*	42		00000000	0	sent as <space>
+	43	•–•–•	01010101	85	Morse $\overline{AR}$
,	44	––••––	110011111	207	
-	45	–••••–	10000111	135	
.	46	•–•–•–	01010111	87	
/	47	–••–•	10010101	149	
0	48	–––––	11111101	253	
1	49	•––––	01111101	125	
2	50	••–––	00111101	61	
3	51	•••––	00011101	29	
4	52	••••–	00001101	13	
5	53	•••••	00000101	5	
6	54	–••••	10000101	133	
7	55	––•••	11000101	197	
8	56	–––••	11100101	229	
9	57	––––•	11110101	245	
:	58	–––•••	11100110	230	
;	59	–•–•–•	10101110	174	
<	60		00000000	0	sent as <space>
=	61	–•••–	10001101	141	Morse $\overline{BT}$
>	62		00000000	0	sent as <space>
?	63	••––••	00110110	54	
@	64		00000000	0	sent as <space>

Character	ASCII	Morse	Binary Encoding	Decimal Encoding
A	65	•–	01000010	66
B	66	–•••	10000100	132
C	67	–•–•	10100100	164
D	68	–••	10000011	131
E	69	•	00000001	1
F	70	••–•	00100100	36
G	71	––•	11000011	195
H	72	••••	00000100	4
I	73	••	00000010	2
J	74	•–––	01110100	116
K	75	–•–	10100011	163
L	76	•–••	01000100	68
M	77	––	11000010	194
N	78	–•	10000010	130
O	79	–––	11100011	227
P	80	•––•	01100100	100
Q	81	––•–	11010100	212
R	82	•–•	01000011	67
S	83	•••	00000011	3
T	84	–	10000001	129
U	85	••–	00100011	35
V	86	•••–	00010100	20
W	87	•––	01100011	99
X	88	–••–	10010100	148
Y	89	–•––	10110100	180
Z	90	––••	11000100	196

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HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Thousands of amateurs have discovered that chasing satellites can be addictive. Many hams with walls full of QSLs and operating certificates have found renewed enthusiasm for their hobby through contacts via the amateur radio satellites and pursuing awards in recognition of their efforts. Several organizations and amateur radio magazines promote operating activities and certificates for interested hams. AMSAT, the Radio Amateur Satellite Corporation, has several intriguing awards and exercises worth seeking.

The AMSAT Awards Program

Over the years, AMSAT has promoted certificates to commemorate special events like the launch of AMSAT-OSCAR-10, the commencement of AMSAT-OSCAR-13 operations, donations for satellite solar cells, the 20th anniversary of the launch of OSCAR-1, the Stoner Challenge Cup Competition, and additional events. Further programs recognizing long-term activities were begun two decades ago and continue today.

The AMSAT Awards Program provides several awards designed specifically for the satellite enthusiast. The first was the Satellite Communicators' Club (SCC) certificate, started in 1973 after AMSAT-OSCAR-6 was safely in orbit. The intention of this program was to document the use of A-O-6 and to promote activity. Two years later AMSAT announced a new award, the OSCAR Satellite Communications Achievement Recognition (AOA) certificate. Earl Skelton WA3THD coordinated the program for four years. During that time two other awards were added, the OSCAR Sexagesimal Award and the OSCAR Century Award. Jim Devilbiss WA3FUJ accepted the responsibilities of the Award Manager position from July 1979 until late 1986 when Andy MacAllister WA5ZIB took over the post. Mike Scarcella WA5TWT accepted the job responsibilities in late 1992 and is the current AMSAT Award Manager.

Satellite Communicators' Club

Just as with the low-band awards, some of the satellite certificates are more difficult to earn than others. Only a single satellite contact is sufficient to qualify for the Satellite Communicators' Club certificate. The original certificate had a drawing of AMSAT-OSCAR-6 in the lower left. It was announced in "Satellite Operating Awards" by Ray Soifer W2RS in the June 1973 *AMSAT Newsletter*. Today's version of the award shows a Phase-3 style satellite in the lower right corner (Figure 1). The printing is dark blue on light-gray textured paper. To receive the award, send a report of a two-way contact through any amateur satellite to the AMSAT S. C. C. Manager, P.O. Box 27, Washington, DC 20044. No form is necessary, and submission of a QSL is not required. Pertinent information about the QSO, along with a self-addressed stamped envelope (S.A.S.E.) and $1 ($2 for non-AMSAT members) should be submitted. Walt Rader WA3DMF handles this program.

AMSAT
The Radio Amateur Satellite Corporation
THIS IS TO CERTIFY THAT
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IS A MEMBER-STATION OF THE
SATELLITE COMMUNICATORS' CLUB
AND IS ENTITLED TO ALL THE PRIVILEGES, PREROGATIVES, RIGHTS, FAVORS, GLORY, RANK, FAME, NOTORIETY, POPULARITY, AND HONOR OF MEMBERSHIP IN THAT WORTHY ORGANIZATION.
AWARD MANAGER

Figure 1. The Satellite Communicators' Club certificate is available for proof of one satellite QSO.

OSCAR Satellite Communications Achievement Award

Originally known as the OSCAR Satellite Communications Achievement Recognition, the OSCAR Satellite Communications Achievement Award (renamed in 1992) is also known as the AMSAT OSCAR Award, or AOA. This accomplishment requires proof of 20 qualified satellite contacts.

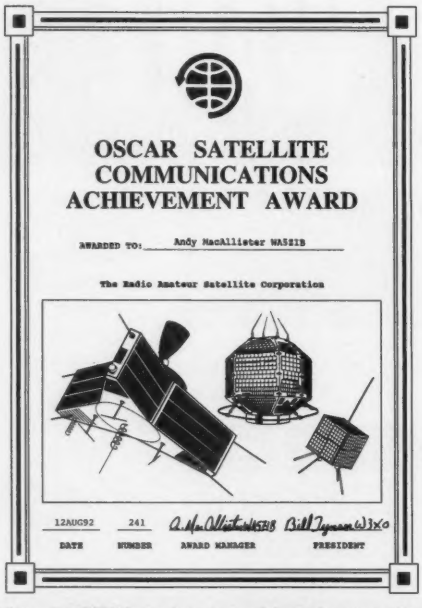


Figure 2. AMSAT's basic award, originally known as the AOA, is available for proof of 20 "qualified" satellite QSOs.

OSCAR SEXAGESIMAL AWARD
This certifies that Andy MacAllister operating
Amateur Radio Station WA5ZIB has submitted evidence to AMSAT Headquarters of having conducted two-way Satellite Communication with other Amateur Stations in at least sixty different Canadian call-areas, United States, other countries, or any combination thereof. This certificate is awarded by AMSAT in recognition of this outstanding achievement in Amateur Satellite Communication.
12AUG92
90
Date
Number
Award Manager
President

Figure 3. The OSA is issued for 60 qualified satellite contacts.

A qualified QSO is one with a different state, Canadian call area or DXCC country, in any combination. Endorsements for each 10 QSOs above 20 are available only for those with certificates dated prior to 1992, when the certificate was updated (Figure 2). The printing is black on beige textured paper. The cost of the award is $3.50 for AMSAT members and $5 for nonmembers. Applicants should include copies of QSL cards or copies of other acceptable proof of contacts (ARRL W.A.S., DXCC, etc.) and return postage. It is preferable not to send original QSLs.

OSCAR Sexagesimal Award

The program for the OSCAR Sexagesimal Award, or OSA, began in 1976 in response to the many endorsement sticker requests for the basic AOA. To receive the OSA, communication with 60 qualified stations is required. Costs and contact constraints are identical to the easier award. Less than 200 applications are on file for the OSA. The certificate (Figure 3) is printed in black on off-white parchment.

OSCAR Century Award

The OSCAR Century Award represents another grade of difficulty beyond the OSA. This award requires 100 qualified contacts via satellite. In 1978 the cost was $5 for members. Today it is the same as the AOA and OSA, i.e. $3.50 for members and $5 for nonmembers. Less than 50 stations have applied for and received the OCA. The certificate (Figure 4) is printed in black on off-white parchment, with the AMSAT logo in red.

SA AMSAT Satellite Communication Achievement Award

Countries besides the United States also promote awards. South Africa AMSAT sponsors their Satellite Communication Achievement Award for making 25 two-way contacts through Phase-II satellites. Presently, that would include all RS (Russian hamsats), A-O-21, A-O-27 and Fuji-OSCAR-20 activity. A-O-10 and 13

OSCAR CENTURY AWARD

This certifies that Andy MacAllister operating Amateur Radio Station WA5ZIB has submitted evidence to AMSAT Headquarters of having conducted two-way Satellite Communication with other Amateur Stations in at least one hundred different Canadian call-areas, United States, other countries or any combination thereof. This certificate is awarded by AMSAT in recognition of this superlative achievement in Amateur Satellite Communication.

12AUG92 — 15 — Andy MacAllister WA5ZIB — Bill Tynan W3XO

Figure 4. The OCA is available for 100 qualified satellite contacts.

SA AMSAT
SATELLITE COMMUNICATION
ACHIEVEMENT AWARD

Andy Mac Allister WA5ZIB

This award is made in recognition of having made twenty-five two-way contacts through Phase II Satellites.

AWARDS MANAGER

AWARD NUMBER S.A. 7

Figure 5. This South Africa AMSAT award is available through AMSAT-NA for proof of contact with 25 stations via low-orbit hamsats.

(Phase-3) contacts are not allowed. The SA AMSAT award is available through AMSAT NA for the usual $3.50 for members and $5 for nonmembers. The certificate (Figure 5) is signed by the SA Awards Manager, Andre Botes ZS2ACP (ex ZR2FK).

The K2ZRO Memorial Station Engineering Award

The K2ZRO Memorial Station Engineering Award Program, or just "ZRO Test," was begun seven years ago by Vern Riportella WA2LQQ via AMSAT-OSCAR-10. This technical achievement activity via satellite honors the memory of Kaz Deskur K2ZRO. Kaz was known in satellite circles for his invention of the Satellabe OSCAR tracking calculator and his active participation in hamsat pursuits since the early days of A-O-6. The purpose of the competition is to promote operating skill and receiver performance by testing the listening capabilities of individuals monitoring the transmissions of a control station through the satellite transponder. The program continues today through the mode "B" (70-cm uplink and 2 meter downlink) transponder of AMSAT-OSCAR-13. Test coordinators during the last seven years have included WA2LQQ, WA5ZIB, W6HDO and N5EM.

Test sessions are scheduled for periods when the satellite is positioned for optimum spacecraft antenna pointing angles with respect to all earthbound listeners. To provide consistency between tests, the best periods are usually near apogee with the satellite pointed directly at the center of the earth's disc.

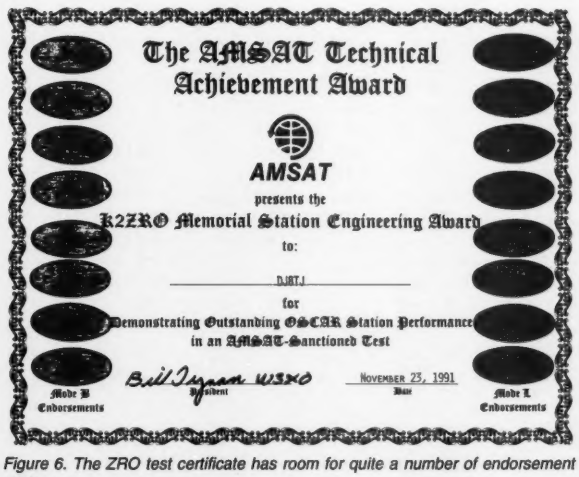
During a test, which runs approximately 25 minutes, the control station will begin the event by matching his downlink signal to the level of the general beacon. After a short 10-word-per-minute message announcing the test, the numeric code groups begin. A random five-digit number is sent three times at the beacon level, level Z0. The control station will then pause and cut the uplink power in half (-3 dB) for a new random number at level Z1. The process continues to ZA at 30 dB below the beacon.

The 30 dB decrease in uplink power is the result of cutting output power in half nine times. At the control station for Mode "B" tests, it is typically the difference between 25 watts out at Z0 and 25 mW out at ZA to a 13 dB gain antenna. Although several hams have copied the signals at Z9 (27 dB down), only one, Darrel Emerson AA7FV, has successfully copied the level "A" signals. At this level the uplink system is equivalent to a handie-talkie running one-half watt through a quarter-wave whip.

The ZRO Test certificate is off-white parchment with dark blue printing and the AMSAT logo in red. It has positions for 16 endorsement stickers, eight for mode "B" silver stickers and eight for mode "L" gold stickers. Due to the demise of the Mode "JL" transmitter a few years ago, the "L" stickers are no longer offered. The addition of a Z9 endorsement was not envisioned when the program was created in 1985. Since there was little room on the certificate for much else without marring one of AMSAT's finest awards, a new enhancement to the ZRO program was created, the Z9 Club. For those who qualify, there is a special individualized certificate (Figure 7). Darrel got a plaque at the 1993 AMSAT-NA Space Symposium and Annual Meeting for his level "A" copy. He also presented a paper in the conference proceedings entitled "Digital Processing of Weak Signals Buried in the Noise."

Test schedules are announced via the AMSAT nets. Reception reports can be sent to WA5ZIB at 14714 Knightsway Dr., Houston, TX 77083. A reply will be sent verifying the lowest level copied. The cost of the basic award is $3.50 for members and $5 for nonmembers. All certificate requests should be sent directly to WA5ZIB. Checks should be made out to AMSAT. Foreign participants are encouraged to include additional funds to cover airmail postage.

The AMSAT Awards Program has been active since the launch of A-O-6. Emphasis in recent years has been on the ZRO Tests, but all of the earlier awards, the SCC, AOA, OSA, OCA and the South African version of the AOA, are still available and make excellent additions to any station. Work continues to update the program. A new advanced award is under study requiring a minimum of 1000 QSOs via satellite. Sounds like a lot? It really isn't when you're into the hamsats. 73



The AMSAT Technical Achievement Award

AMSAT

presents the

K2ZRO Memorial Station Engineering Award

to:

DJ8TJ

for

Demonstrating Outstanding OSCAR Station Performance in an AMSAT-Sanctioned Test

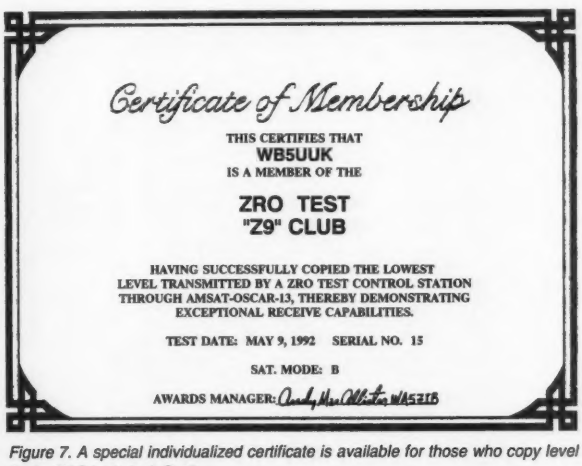
Bill Tynan W3XO — President

November 23, 1991 — Date

Mode B Endorsements

Mode L Endorsements

Figure 6. The ZRO test certificate has room for quite a number of endorsement stickers.



Certificate of Membership

THIS CERTIFIES THAT
WB5UUK
IS A MEMBER OF THE

ZRO TEST
"Z9" CLUB

HAVING SUCCESSFULLY COPIED THE LOWEST LEVEL TRANSMITTED BY A ZRO TEST CONTROL STATION THROUGH AMSAT-OSCAR-13, THEREBY DEMONSTRATING EXCEPTIONAL RECEIVE CAPABILITIES.

TEST DATE: MAY 9, 1992 SERIAL NO. 15

SAT. MODE: B

AWARDS MANAGER: Andy MacAllister WA5ZIB

Figure 7. A special individualized certificate is available for those who copy level 9 of a ZRO test via A-O-13.

RTTY LOOP

Number 15 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

I don't know anything more near and dear to an amateur's heart than looking for that next contact. We build equipment, run cables, stay up late and disrupt our spouses, parents, or neighbors, all in search of that elusive QSO. We are looking for conversation, information, or just a place to spout off. Ham radio started off with long waves and spark, and has progressed to tiny little short waves with audio, video, and digital information. For many of us, some of what we do isn't even on the air!

Over the past few years I have ended this column with the notation that I am available on a number of computer data services. and many of you have taken advantage of that fact to reach me. Well, now there is a new venue in town, one which is designed just for us.

Delphi, one of the most affordable computer services, has opened a "Radio SIG" which features amateurs at the helm, and multiple databases of interest to amateurs, CBers, and SWLs.

Marty Goodman KC6YKC, who was a great help in getting the Radio Shack Color Computer onto RTTY some years back, was instrumental in starting this special interest group. Marty told me that, in the past, ham radio in particular, and radio hobby stuff in general, has been handled on Delphi as a subtopic within the HOBBY SIG, founded by Charles Bachand (BACHAND on Delphi). Charles actually amassed a fair amount of ham-related files of interest for the database in that topic area.

About two years ago or so, Andy Eddy WB1FNV (VIDGAMES) approached the Delphi management regarding the possibility of setting up a separate ham radio SIG. At that time the suggestion could not be implemented.

About a year ago, Marty was brought in as a SIGop for the HOBBY SIG's Ham Radio topic area by Charles Bachand, after the two had become acquainted in the computer arena.

Marty, not knowing of Andy's earlier efforts, then approached Delphi about setting up a ham radio SIG, but again the idea bore no fruit. Then, about nine months ago or so, Andy approached Marty and told him that Delphi had indicated that the two of them could receive approval for a jointly-founded ham radio SIG.

Both of these gentlemen had extensive experience in computer SIGs. Andy has about four years' experience managing SIGs on Delphi, having been the manager on the Delphi Atari SIG, and on the World of Video Games SIG. Marty has about 10 years experience with the CoCo and OS9 SIGs on Delphi.

Unfortunately, Delphi was undergoing growth pangs at the time the new SIG was planned, and the anticipated SIG has taken a bit of time to see the light of day. Called the "Radio SIG," it supports a variety of radio hobbyists in addition to ham radio types: SWL DXers, scanner users, CB users, and satellite TV users. Even the few broadcast radio types seen on the Hobby SIG are welcome.

Within a couple of weeks of the opening of the service, over a thousand people have visited the SIG. The forum will have seen nearly a thousand messages in the first six weeks of the SIG's existence. As of this writing, there are over 300 groups of files in the data base, with new files being added daily. Of special interest to hams is a plethora of files detailing radio modifications, gleaned from the best available sources. The Radio SIG has established a cordial relationship with *Newsline*, and each week's *Newsline* is posted regularly.

Data bases available on the Radio SIG include:

General Information
VHF/UHF Ham
HF Ham
Listening
Hardware Mods
ARRL
Vendors/Reviews
Packet Radio
New Arrivals

Under each of these topics are hundreds of files, arranged into groups, on a wide variety of topics. Packet and RTTY programs, equipment reviews, service bulletins, clock programs, and other assorted goodies are yours for the downloading. There is a good likelihood that the programs of the various "RTTY Loop" collections will show up there as well.

To join Delphi, call Delphi Member Services at 1-800-695-4005, or at (617) 491-3393 from within Massachusetts or outside the United States. I mentioned at the beginning of this column that Delphi is affordable. Well, there are two package plans for joining Delphi: the 10/4 Plan, and the 20/20 Advantage Plan. The 10/4 Plan, at $10 per month, includes the first four hours of use each month. Additional use is $4 per hour (actually billed as 6.6 cents per minute). The 20/20 Advantage Plan, at $20 per month, includes the first 20 hours of use each month. Additional use is $1.80 per hour. There is a one-time enrollment fee of $19 for this second plan (discounted if chosen during the first month).

Just to further interest you, the Radio SIG is not the only special interest group of note on Delphi. Here is a listing of the full "Groups and Clubs" menu:

Aviation Sig
Business Forum
Close Encounters
Golf SIG
Custom Forums
Environment SIG
GameSig
Hobby Shop
Languages and Cultures
MensNet
Music City
New Age Network
Person to Person
Photography & Video
Radio SIG
Science Fiction Sig
Senior Forum
Sports Connection Online
Theological Network
TV/Movie Group
USA Gymnastics
WCF—World Community
WIDNet-Disability Network
Yachting SIG
World of Video Games
Writers Group

Of course, that's not all—there are also a bunch of entertainment and game services, reference and education, shopping, news, and travel services. Delphi is even interfaced with Internet, and can both port to Internet and be reached from Internet.

All in all, Delphi (which, by the way, is accessed with any simple text-based terminal for its menu driven interface) may represent the best hidden value in computing today. Give them a call, and let them know that you read about it here, in *73's* "RTTY Loop." And see you on the Radio SIG!

Of course, for any of you who just can't wait, the now-five disks of RTTY and affiliated software remain available from the above address. Send sufficient media (each collection fits on a 3.5" 1.44 Mb HD disk), $2 for each disk to be filled, and a stamped self-addressed return mailer, specifying the collections desired. A stamped, self-addressed envelope sent to me will get you a listing of the directories of the collections. As always, I look forward to your comments and questions both by SnailMail and Email. The latter to me on CompuServe (75036,2501), Delphi (MarcWA3AJR), or America Online (MarcWA3AJR). Internet users, please direct Email to me via marcwa3ajr@aol.com—it seems to be the fastest route overall.

We have reviews of a couple of commercial packages in the pipeline, with more on the shareware scene as well. All this as next month begins the 18th year of RTTY Loop!

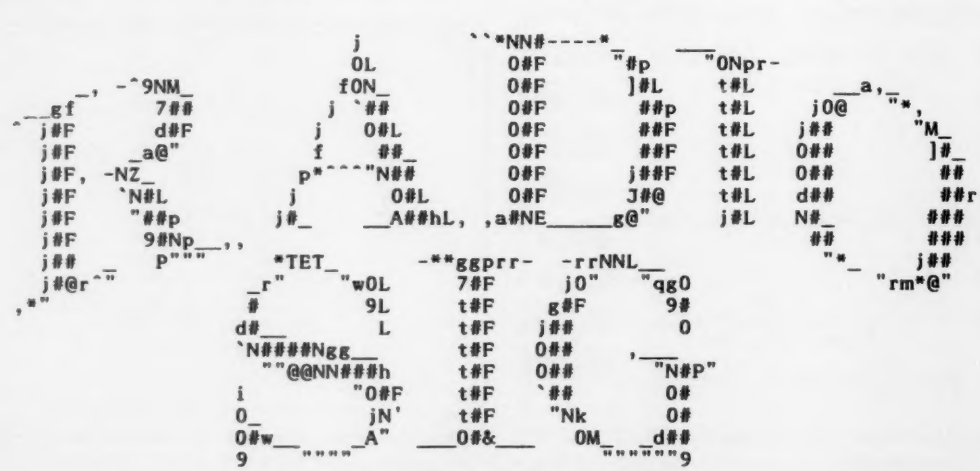
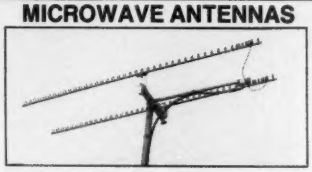


Figure 1. The sign-on banner of the Radio SIG.

MICROWAVE ANTENNAS



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2445LYK	45el	loop Yagi Kit	1269 MHz	21 dBi	$103.00
1844LY	44el	loop Yagi Kit	1691 MHz	21 dBi	$115.00
2355LYK	55el	loop Yagi Kit	1296 MHz	22 dBi	$118.00
1345LYK	45el	loop Yagi Kit	2304 MHz	21 dBi	$85.00
945LYK	45el	loop Yagi Kit	3456 MHz	21 dBi	$85.00

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100 mw version $300
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2340 PA	1W in 35W out	1240-1300 MHz	$355
2370 PA	5W in 70W out	1240-1300 MHz	$695
3318 PA	1W in 20W out	902-928 MHz	$275
3335 PA	14W in 40W out	902-928 MHz	$335
3310 PA	10mW in 10W out	902-928 MHz	$150
432 PA	70mW in 18W out	420-450 MHz	$180
50 - 222 Mz version now available			Write

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23LNA	preamp .5 dB NF	1296 MHz	13.8V	$ 95
13LNA20WP	preamp .7 dB NF	2300-2400 MHz	13.8V	$130
1691LNAWP	preamp 1 dB NF	1691 MHz mast mounted	13.8V	$140
4017LNAK	preamp kit	400-1700 MHz	.8dB	$ 40
Preamp kits for 2304-10 GHz weatherproof versions available				Write or Call

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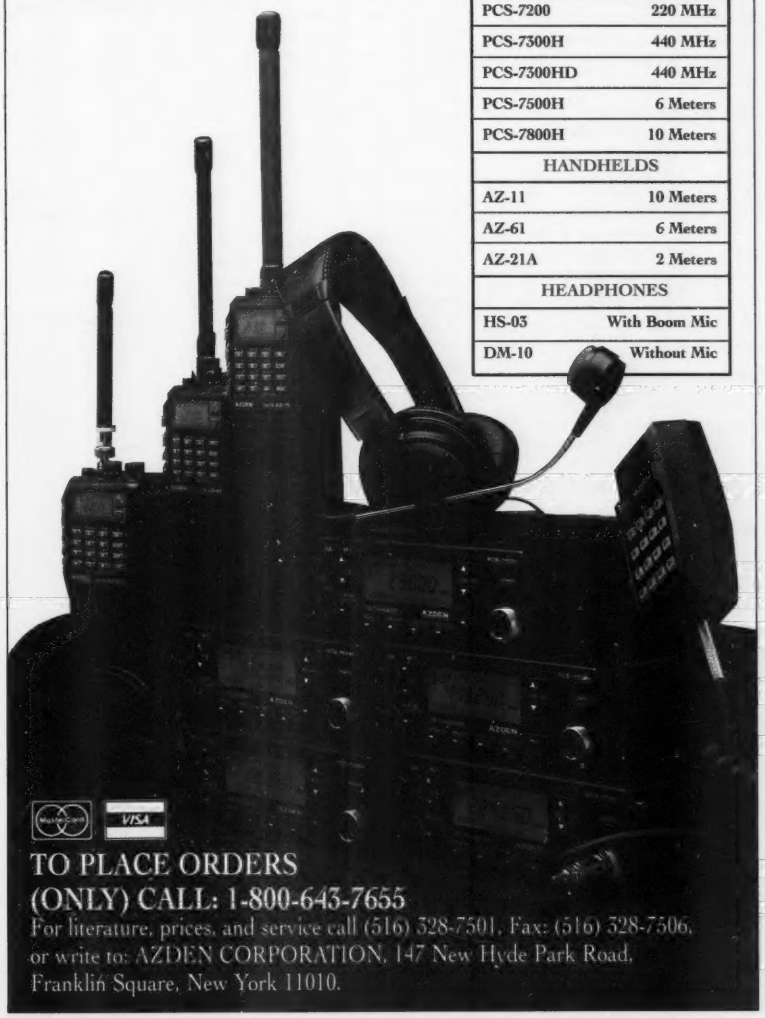
HANDHELDS	
AZ-11	10 Meters
AZ-61	6 Meters
AZ-21A	2 Meters
HEADPHONES	
HS-03	With Boom Mic
DM-10	Without Mic



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Circuit Design Software for Hams

Reviews of the Z-Match for Windows and Analyser III Software

Some months back I reviewed a printed circuit layout and schematic drawing program called Easy-PC by a company called Number One Systems, Ltd. of England. I use that program to design the printed circuit boards you see in this column from time to time. That program was so useful to me that I obtained copies of two more programs from the same company: Analyser III and Z-Match for Windows; both programs are reviewed here . . . and I'm impressed.

First, the company, Number One Systems, Ltd. is British, but they have a U.S. office (which often advertises in *73*). The addresses for the company are:

England — Harding Way
Somersham Road
St. Ives, Huntingdon
Cambridgeshire, England
PE17 4WR
Phone from USA:
011-44-480-461778

USA — 1795 Granger Avenue
Los Altos CA 94024
Phone: (415) 968-9306

Now let's take a look at the programs.

Z-Match for Windows

Anyone who designs RF circuits rapidly comes to the Smith chart, one of several charts developed in 1939 by Phillip Smith of Bell Labs. The Smith chart is often viewed by amateurs as somewhat daunting to use because it is tedious to construct. The Z-Match program makes that chore easy.

Figure 1 shows the impedance form of the Smith chart, while Figure 2 shows the admittance form of the chart. The program shows the Smith chart display on-screen. It will do admittance-impedance conversions, lumped L and C circuits, transmission line problems, is an S-parameter calculator, and has a host of other features. It solves problems involving RF transistors, complex LC networks, impedance matching networks, and transmission lines. It accounts for line losses, dielectric losses, velocity factor, frequency and characteristic impedance, and gives solutions in terms of standing wave ratio (SWR), reflection coefficient (b), actual line length and component values. Because I am interested in antennas, I plan to use Z-Match quite a bit in my playing around with new things.

Hardware required to run Z-Match for Windows is any Windows-compatible machine using a 286 or later processor (e.g. 386, 486, Pentium). It needs to see Windows 3.0 or later. However, one might find that performance on 286 machines suffers a bit. However, on both my 386 machine and 486 machine it ran well and worked splendidly. It requires 1 mbyte of free memory space on the hard drive. Otherwise, the system requirements are modest.

Analyzer III

The Analyser III software is MS-DOS based, and will run in either the DOS 3.0 (or later) or Windows environments. Under DOS, one enters "AN3" to start the program. Under Windows I run the program from the File Manager option (Windows Set-Up did not recognize Analyzer III, which is not uncommon for a DOS-based program). The program will run on machines not equipped with a hard drive, but because there are exchanges to the disk, using a floppy will slow things down a bit. Any processor from 8088 through 486 will run the program. RAM memory required is 640K.

Analyser III is used to analyze linear circuits, including filters, amplifiers, crossover networks, wideband

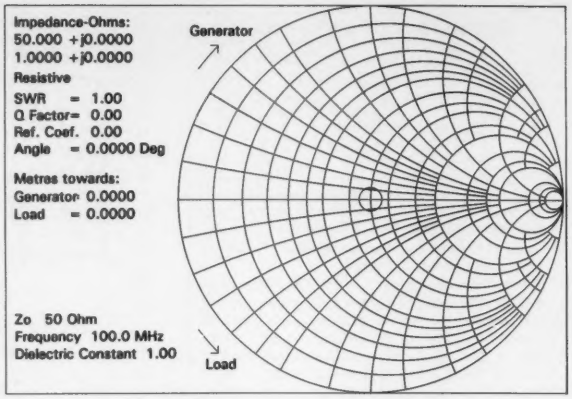


Figure 1. Impedance Smith chart graph from Z-Match.

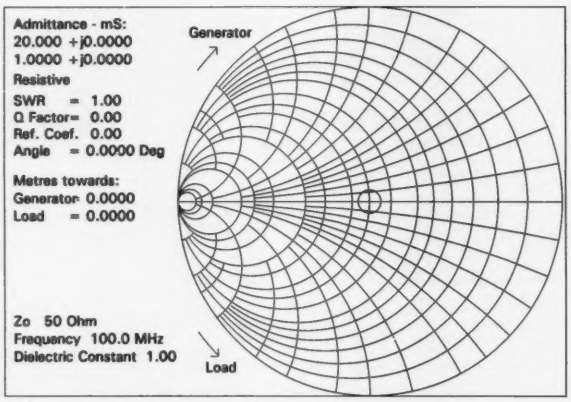
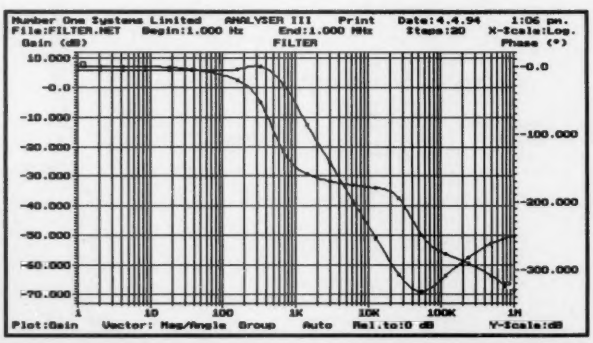


Figure 2. Admittance Smith chart graph from Z-Match.



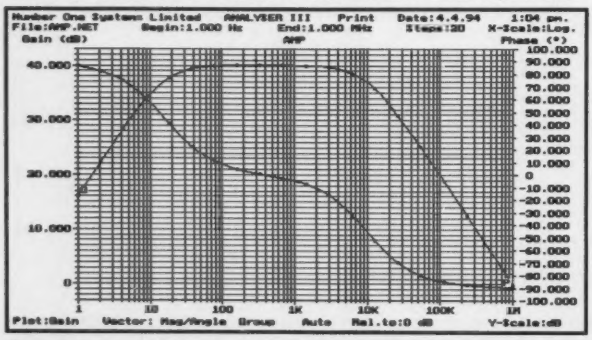


Figure 3. Gain and phase responses vs. frequency plot for an op-amp noninverting follower from Analyser III.

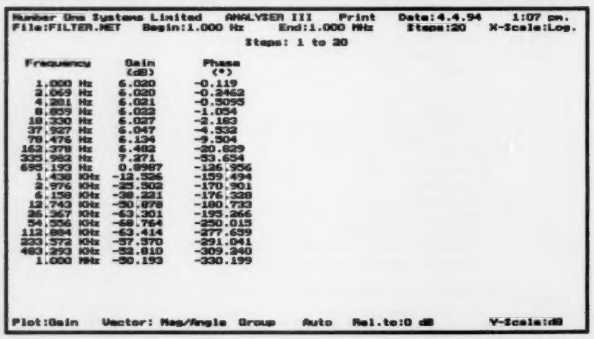


Figure 4. A) Gain and phase responses vs. frequency plot for an op-amp Sallen-Key filter from Analyser III; B) Numerical readout of same data as in Figure 4A.

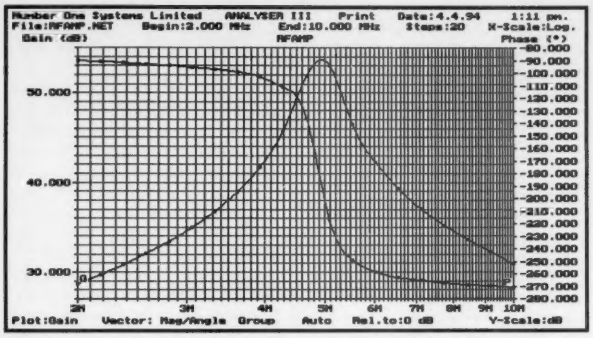

Number One Systems Limited ANALYSER III Print Date:4.4.94 1:11 pm.
File:RFAMP.NET Begin:2.000 MHz End:10.000 MHz Steps:20 X-Scale:Log.
Gain (dB) RFAMP Phase (°)
50.000
40.000
30.000
2M 3M 4M 5M 6M 7M 8M 9M 10M
Plot:Gain Vector: Mag/Angle Group Auto Rel.to:0 dB Y-Scale:dB

Figure 5. Gain and phase vs. frequency plot for a 5 MHz RF amplifier from Analyser III.

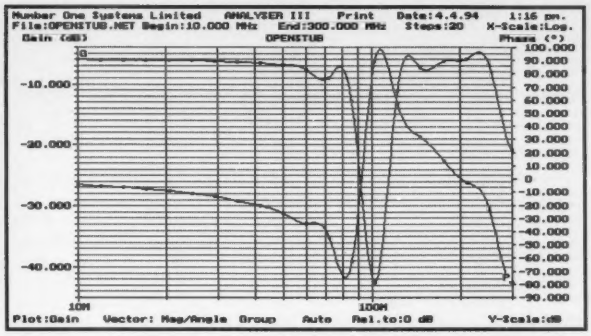

Number One Systems Limited ANALYSER III Print Date:4.4.94 1:16 pm.
File:OPENSTUB.NET Begin:10.000 MHz End:300.000 MHz Steps:20 X-Scale:Log.
Gain (dB) OPENSTUB Phase (°)
-10.000
-20.000
-30.000
-40.000
10M 100M
Plot:Gain Vector: Mag/Angle Group Auto Rel.to:0 dB Y-Scale:dB

Figure 7. Open transmission line stub gain and phase plot from Analyser III.

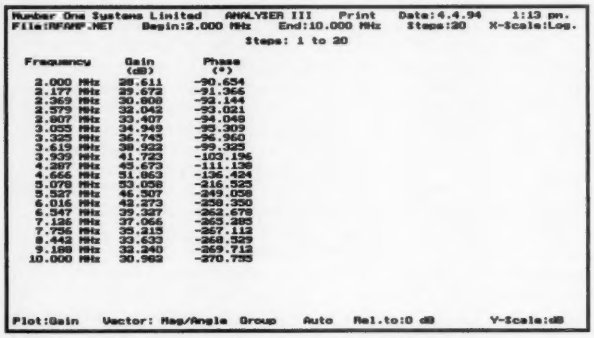


Figure 6. Numerical data for the plot of Figure 5.

amplifiers, antenna matching networks, RF/IF amplifiers, video/TV circuits, linear IC circuits, transistor circuits, and other networks operating in the range 0.001 Hz to 10 GHz.

You can use either one of the circuits or devices in the library supplied with the program, or build your own network and enter it into memory as a new library item.

The first screen after the opening will have a menu bar along the type, and one of the options is the File. From this menu (which can be clicked with a mouse or accessed with the "F" key) select "Load a Circuit." A window opens, and lists a number of .NET files from the library. Once the file is loaded, the frequency response plot appears on the screen. You can also select a numerical listing of circuit parameters.

Figure 3 shows the circuit for a universal operational amplifier in the noninverting follower configuration. Two curves are plotted in Figure 3: frequency response and phase (in degrees). The horizontal axis is a logarithmic frequency scale running from 1 Hz to 1 MHz. The left vertical axis is gain in decibels (dB), while the right vertical axis is phase in degrees from -100 to +100 degrees. The gain curve shows about 40 dB gain at mid-band, falling off below 30 Hz and above 4 kHz. Parameters are calculated at 20 points within the frequency range.

Figure 4 shows the plot for a Sallen-Key filter with a gain of two, and a cut-off frequency of about 500 Hz. The horizontal frequency scale is the same 1 Hz to 1 MHz logarithmic scale as before. The left vertical scale is gain in dB, while the right scale is phase from 0 to -300 degrees. Again, 20 points are calculated. A numerical printout of the same data is shown in Figure 4.

The plot for an RF amplifier is shown in Figure 5. The horizontal scale is frequency from 2 MHz to 10 MHz. The frequency scale is logarithmic, although that may not be immediately apparent because only one 10:1 cycle is shown. This particular RF amplifier is centered close to 5 MHz. As in the previous cases, there are two plots: frequency response and phase. Figure 6 shows the numerical plot. This plot shows that the actual peak in gain (given the number of points plotted) is around 5.078 MHz.

The example shown in Figure 7 is for an open transmission line stub (the program includes a shorted stub example as well, but it is not shown here). Stubs are often used in antenna circuits for impedance matching, phase shifting and other tasks. Like the other circuits, gain and phase are plotted against frequency. In this case, the frequency axis (horizontal) runs from 10 MHz to 300 MHz, and is logarithmic.

The examples given above are from samples provided with the software. You can enter your own network and have the software analyze it.

General Comments

In general, the manuals for these two programs were clear and easy to follow. I would like to see a better index in the rear, as some topics are a bit hard to find. However, I experienced no real problems in installing, setting up or using the software. Contact Number One Systems, Ltd. at one of the addresses given above for further information about Z-Match for Windows, Analyser III and Easy-PC.

"In general, the manuals for these two programs were clear and easy to follow."

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But T-hunting (or foxhunting, as it is sometimes called) is 10 dB more adventurous when you're doing it in a land where persons with radio gear are automatically suspected of subversion. Such was the fate of Mark Oppenheim KD6KQ. This adventuresome ham has made a dozen trips to third-world countries as a staff member of Volunteers in Technical Assistance (VITA).

For 35 years, VITA, a non-profit aid organization, has applied modern technology to meet the needs of emerging nations. Regular VITA broadcasts on the Voice of America result in a steady stream of incoming requests for information and assistance on technical subjects ranging from candlemaking to oil drilling to digital communications.

VITA staff and volunteers attempt to match inexpensive technologies to these problems. Computers and packet radio equipment are cheap when compared to commercial digital communications methods, so they are often selected for such applications (on non-ham frequencies, of course). KD6KQ first heard about VITA in 1989 from a packet message, requesting volunteers to go to The Sudan to set up solar-powered HF packet stations for village communications.

Low-orbit store-and-forward packet micro-satellites such as UOSAT-14 are perfect for inexpensive, reliable intercountry messaging, so VITA has seized the opportunity to use them. In September 1991, a team led by Eric Rosenberg WD3Q set up the agency's first ground station in Sierra Leone. Eric approached the National Telecommunications Company (NTC), the country's equivalent of the FCC, for permission to communicate with UOSAT-14 on 429 MHz, which is just below the 70 cm ham band in that part of the world. NTC's frequency coordinator is Cassandra Davies 9L1YL (Photo A), who said there would be no problem. Only VHF was used there, so there was no need for coordination on UHF frequencies.

Unfortunately, when 9L1/WD3Q switched on the ground terminal receiver, he discovered that the QRP satellite signals were being obliterated by a strong carrier. With the meager test equipment he had with him, he couldn't tell if the cause was a computer in the next room or a strong transmitter miles away. He returned to the USA and KD6KQ was dispatched to solve the problem.

Wild and Woolly

Sierra Leone (meaning "Lion Mountains") is on the west coast of Africa, between Guinea and Liberia. Freetown, the capital city, has a magnificent harbor, the third largest in the world. English is the official language of this nation of 4.5 million people. It is one of the wettest countries on earth, averaging over 140 inches of rain per year.

You will count your blessings as you hear KD6KQ describe daily life in Freetown. Fuel shortages are chronic, sometimes leading to fights at gas stations. Most electronic equipment is powered by batteries because families lucky enough to have electrical wiring to their homes receive power only an hour or two a week, on average.

"People steal the power wiring and sell the copper for salvage," says Mark. "They had a problem with the power station generator, which was built over 50 years ago. The workers had to take off the belt housing to get at the windings. They sent off to the UK for parts and while they were waiting, the belt housing was stolen. Similarly, you quickly learn that the telephones of developing countries are just a novelty. The Sierra Leone phone system is very erratic. Sometimes the international lines go out for days."

Despite all this, KD6KQ says there is an active ham radio community there, particularly among immigrants from Lebanon. Old tube-type HF rigs are common. Hams there form small clubs to pool their meager station resources. Forty meters is the most popular band.

Not knowing what to expect, but wanting to travel light, Mark took a UHF beam, a Wavetek RF attenuator, and an IFR UHF service monitor with built-in spectrum analyzer. "I wasn't sure what we were dealing with and I thought it might be nice to be able to observe the modulation," he said. Upon arrival, he carefully aimed the ground station antenna for maximum interfering signal level in the receiver. Then he went to the roof and looked down the antenna boom. The antenna pointed toward the airport.

Freetown and its harbors are on a peninsula. The airport is on the mainland, a three- to five-hour drive away, depending on the weather. The ferry system is not an attractive alternative. "Ferry schedules are timed to the infrequent airline arrivals and departures," Mark said. "You can get stuck over there for five or six hours. I was thinking, 'I hope I don't have to go to the airport, because I'll have to book the ferry in advance, then be stuck on a boat with goats and other strange animals.'"

With the service monitor, RF attenuator, and a portable yagi, KD6KQ and a helper set out to track the signal. Sure enough, they soon arrived at the beach with the antenna still pointing across the bay toward the airport (Photo B). Instead of immediately calling the ferry company,

Photo A. Cassandra Davies 9L1YL was president of the Sierra Leone Amateur Radio Club when KD6KQ went on his QRM hunt. She has her station at the NTC office because electrical power is more reliable there.

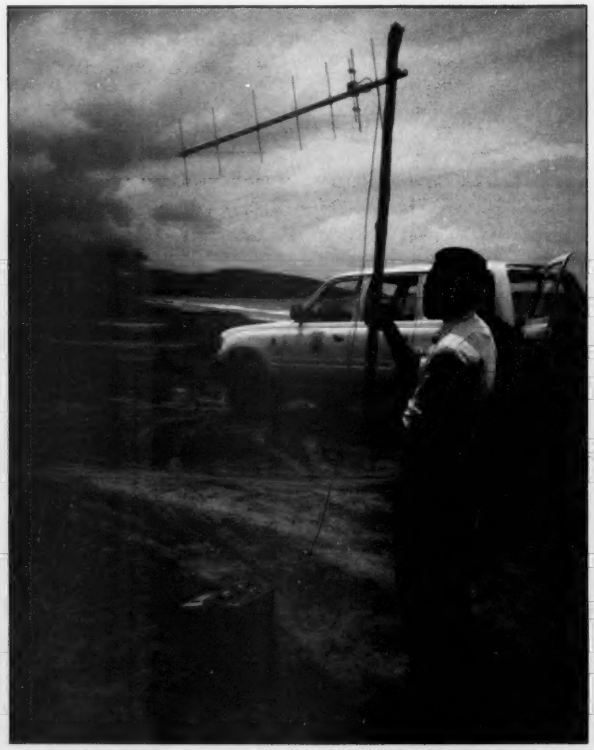

Photo B. Using a spectrum analyzer, attenuator and yagi, KD6KQ and helper Desmond Cole ended up at the beach, with the signal still appearing to come from the airport across the bay.

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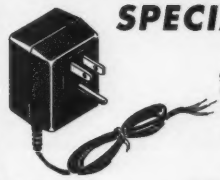

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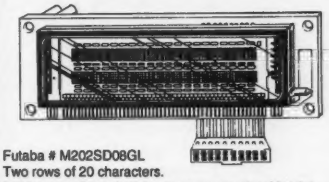

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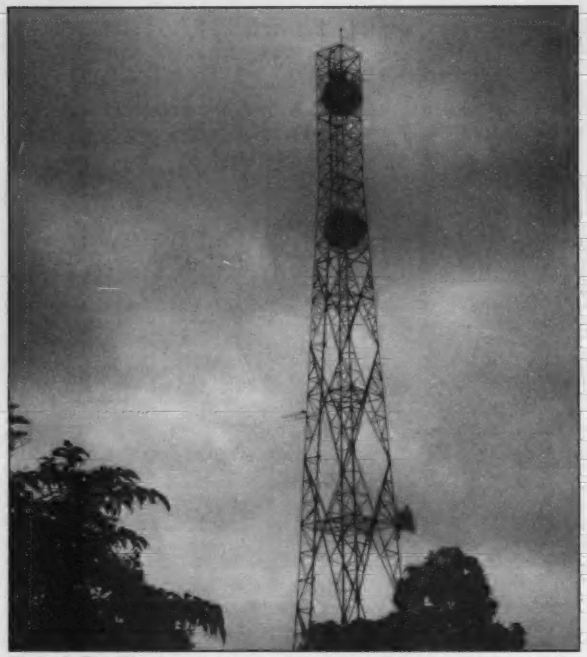

Photo C. The offending signals were being transmitted from the airport to this small yagi, halfway up the tower in downtown Freetown.

Photo D. Thomas Karima, a NTC telecommunications engineer, changed the frequency of the airport telephone link with help from VITA.

KD6KQ decided to do some signal analysis first.

"With the service monitor, I took a look at the spectrum," he went on. "I saw all sorts of interesting sidebands and other activity that was not symmetrical at all. I tuned in some of the sidebands and I was able to hear things like dial tone, busy signal, and people talking. Aha, it must be a telephone link! It's probably communicating with something on this side of the bay. I tuned around the band and down at around 412 MHz I saw a similar emitter. I peaked that up on the beam, and it pointed to a huge tower in the town center."

Just Like 007

Thinking he might avoid a trip to the airport, KD6KQ decided to check out the source of the 412 MHz return signal. Was it really coming from the big tower? This meant RDFing in downtown Freetown, which was sure to arouse suspicion.

"We ended up taking a terrorist approach to DFing," Mark continued. "In most of these countries, if they catch you with anything more advanced than an AM radio, there's always a chance they'll think you're some sort of spy and you'll go directly to jail. So we would park the car, look around, jump out, put the antenna out on a stick, spin it to take a bearing, and throw the stuff back in the car real quick. The whole process took less than 30 seconds each time.

"We didn't have a map, but the tower was easy to see around the town. Sure enough, our RDF antenna always pointed to a little yagi on the side of the big structure. The yagi was aimed toward the airport (Photo C)."

Back at the NTC building, KD6KQ discovered that the man in charge of the local phone system, who worked only two doors down the hall from 9L1YL, had never bothered to notify her of the installation of this UHF phone link. According to Mark, "The airport transmitter was emitting a 2-MHz-wide analog T-1 signal, with sidebands every 350 kHz, at just above 430.0 MHz, inside the amateur band."

Pointing out that sidebands of the system were interfering with both the UOSAT-14 system and the 430 MHz ham band, he pressed them to QSY the link, offering his technical services. There was a delay while everyone waited for an important official to return from the countryside and make the final decision. Meanwhile, Mark went into the helping-ham mode. "9L1YL had a slightly ill Swan transceiver that I volunteered to repair for her," he said. "It's amazing how fast things fell into place once that radio got fixed. It only took us about three days to go out and QSY the link.

"I made a couple of trips to the mainland to swap cards and reconfigure the system (Photo D). Airports are usually pretty strict about their communications, so I figured that they would only let us yank the link down in the dead of night. As it worked out, we went out there to swap some modules and they took it down right at lunchtime. The only problem we had was that the audio baseband board decided to fail at the same time, but we fixed that easily."

A heart-pounding T-hunt is not an everyday activity for VITA volunteers, but they have plenty of interesting challenges. "I'll do anything in a developing country," says KD6KQ. "It's a lot of fun, despite the drawbacks. VITA is looking for people who don't mind going to little-known African countries and places that are unsettled, like Pakistan, to install radio communications equipment. You need both technical know-how and sensitivity to local concerns and customs."

If the idea of electronic adventures in remote corners of the world appeals to you, call VITA headquarters in Arlington, Virginia, at (703) 276-1800 to get a VITA volunteer package. According to KD6KQ, "The best person to talk to is Eric Rosenberg WD3Q. VITA will send you a long questionnaire. You check off your areas of expertise and then your file goes into the computer for matching with upcoming assignments."

In Other News . . .

Judging by my mail, unlicensed operation in our stateside VHF bands is on the increase, often by young people using hand-helds. For instance, Paul Plasters WA3FFL of the Rockford (Illinois) Amateur Radio Association wrote to tell how he and three others (N9OTC, N9VGE, and WB9VLK) tracked down a would-be broadcaster who delighted in making philosophical pronouncements to no one in particular on a local repeater. This pirate used a number of different names and callsigns.

Paul wrote, "Our local foxhunts have given us a lot of experience in RDF. Our group uses several different types of gear, as no one type is right for all occasions. Unfortunately, the search was hampered by indignant licensed hams who put carriers and tones on top of the bootlegger, increasing the difficulty of the hunt."

Upon locating the house from which the signals were emanating, two of the hunters went to the door and asked the mother if she had a son whose hobby was radio communications. "Upon receiving an affirmative answer, we asked if we could come in and converse with her and her husband," Paul continued. "They said they had no idea that what their son was doing was illegal. The father had purchased the handie-talkie from a ham radio dealer in another state."

Several HTs had been stolen in the area lately, so just to be sure, they checked the serial number of the radio. Then they explained to the parents the possible repercussions of continued bootlegging and told them about the club's meetings and license classes.

Let's hear how your club has dealt with unlicensed repeater users. What methods do you use to get repeater users to discreetly cooperate during the hunt? Once caught, should bootleggers be welcomed at meetings and encouraged to take license classes? Have "reformed" bootleggers gone on to become good hams in your area? Write to me at my California address or send e-mail to JoeMoell@cup.portal.com (Internet) or 75236,2165 (CompuServe). My packet address is KØOV@WB6YMH.#SOCA.CA.USA.NOAM.

Number 18 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
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Driving The Point Home

After 14 years of being actively involved with training youngsters in ham radio classes and with recruiting people of all ages, I've come to view everyone as a potential ham. Therefore, I really shouldn't have been surprised about what happened with one of our school bus drivers. The local Staten Island newspapers loved this story and gave it lots of coverage.

Ed Pedersen, is a 59-year-old driver for the Pioneer School Bus Company at Intermediate School 72, now has a new perspective on school and a new relationship with his young passengers. Ed is attending a class with them.

Ed is the bus driver at the slot where I have bus duty every afternoon at dismissal time. We began chatting one day, and Ed asked me what subject I taught. (A fatal question to ask me!) When I told him I teach amateur radio to sixth-, seventh-, and eighth-graders, he became very excited. He told me that he always hears the kids on the bus talking about the fun things they do in that class and he was curious about it.

I gave him an overview of what I do with the youngsters in the radio classes and I invited him to attend a session of the CQ All Schools net. He came in one Tuesday afternoon and listened to the children speaking to other radio operators in California and Texas. The students totally accepted his presence and explained all the goings-on to him. Ed said he loved it, and asked if he could attend the sessions when I do the net on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz. Of course, we gave him a standing invitation.

Ed is a retired manager for AT&T, and has some background in communications. He said he really got interested in amateur radio when he bought a boat with a marine radio. "I just find it fascinating; it's a small world, you know," said Pedersen, who was thrilled when he spoke with a teacher from the Navajo Indian Reservation in Sun Valley, Arizona, during a recent class. Ed told me that he had just finished reading *Bury My Heart at Wounded Knee* and that he got new insight into the Indians and what they went through. He spoke with our net contact, Gary Ragsdale KB7PXI, at the reservation and thoroughly enjoyed the radio contact. He was really overwhelmed when his first QSL card arrived from Gary.

Imagine what a kick it is for me to see Ed's collection of QSL cards (he now has half a dozen) hanging up above the side window of the bus. Every time I come out to bus duty, Ed can't wait to tell me what he's been studying and how much he's enjoying sharing his experiences with his young passengers.

Photo A. The kids love having Ed join us on the CQ All Schools net on Tuesdays and Thursdays.

Pedersen jokes that he's "too old to be a student." He admits that he's taking notes during the program and buying books to help him prepare for the FCC Novice exam. He showed me the stack of code tapes and license manuals he keeps under his seat on the bus. Whenever he gets a few minutes, he studies. He told me that he has given away all the other reading material he used to keep on the bus for the times when he'd be parked and waiting for the kids to come out of school.

The children and I are delighted to have Ed as a regular member of our class when we do the net. From Ed's point of view it has given him a rare opportunity to see what is going on inside the school building. "It's a very rewarding program. It's an eye-opener for me because as bus drivers we don't realize what is being done inside the schools. You can easily see how interested the students are in this program. You don't see that in too many classes" said Pedersen.

It's really funny to see the kids running to Ed's bus to see what new QSL cards he's got hanging up. The cards are the common ground he shares with his afternoon passengers who, he said, board the bus and talk about ham radio class with him.

The moral of the story is to always be ready to enthusiastically talk about ham radio to anyone who will listen. You never know whose life you'll be instrumental in changing forever. 73

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QRP

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Wire down the furniture and warn the neighbors! The second printing of the *HW-8 Handbook* is finished. Ever since the first run sold out in the late part of '91, I've been telling everyone I'm going to reprint the handbook. Well, after miles of walking up and down I-77, I finally picked up enough aluminum cans to finance the second print run.

What's Inside?

The *HW-8 Handbook* is filled with modifications for the HW-8 and the HW-9. There are only a handful of modifications for the HW-7. In fact, if you're looking for a modification to improve the receiver in the HW-7, it won't be in the *HW-8 Handbook*. Nearly all the modifications cover the HW-8 and the HW-9.

Since this is only a reprint, no new modifications have been included. So, if you have the first *HW-8 Handbook*, there is no need to get this one.

The price for the *HW-8 Handbook* is $11, including first class shipping to all of North America. All others add $4 for air mail shipping. You can get your own copy by dropping me a check with your name and address. I would not wait too long, only a limited amount of copies have been printed. They won't last very long. Perhaps down the road I'll get enough new modifications for a new version. So, if you have a modification for the HW-7, HW-8, or the HW-9, send them my way.

Everyone knows by now, Heathkit is no longer in the kit business. However, you might be able to get a condensed operating manual and schematic for some of their rigs. Since the schematics are copyrighted by the Heath company, I was unable to reprint the schematics for these three QRP rigs. I sent several letters to Heath asking for permission, but never got a word back. Oh well!

Pacific Crest Bicycle Trail

Bil Paul KD6JUI of San Matero, California, sent this in. He's looking for some QRP contacts along the bicycle trail with other QRPers. The bicycle tour from last summer sounds interesting. Here's the note I received from Bil:

"The week-long July trip involved four hams and one non-ham, and covered about 400 miles along mountainous paved and unpaved roads between Mt. Saint Helens, WA, and Crescent Lake, OR. The four hams, Guy Hamblen of Troutdale, OR, Dan Arbogast of Corvallis, OR, John Talstad of Monebello, CA, and organizer Bil Paul of San Mateo, CA, operated CW QRP on 40, 20 and 15 meters and used 2 meter HTs. Solar cells were used to charge batteries during each day's ride. All contacts were stateside, with the exception of one Finland contact on 20 meters using a tree-hung ground plane."

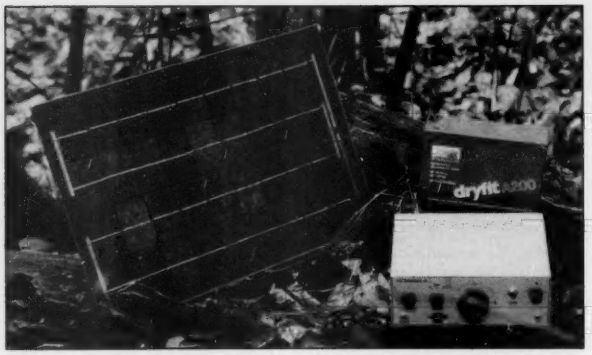

Photo A. Using the Solarex MSX-10L and the Backpacker II in the woods. The sealed gelled battery provides most of the power.

"The upcoming week-long trip will be in July or August of '94 and will begin at Crescent Lake and will include Crater Lake, Ashland, and Siskiyou Pass, OR, and Horse Creek and Callahan, CA. The trip will end near Mt. Shasta. The tour will primarily camp and cook out."

Any experienced bicycle touring folks who are hams are invited to join the free trip. For more information, write to Bil Paul KD6JUI, P. O. Box 5183, San Jose CA 95150.

Bicycling and QRP ham radio seem to be quite a combination. Thanks in part to the low weight of the rigs and the small amount of energy required to operate them, you can throw a QRP rig in the side bags of your bike and not even notice it's there.

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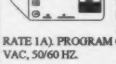

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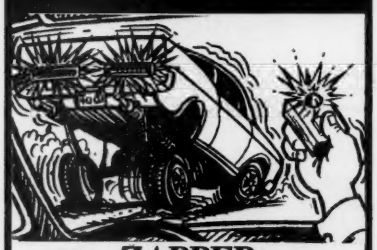

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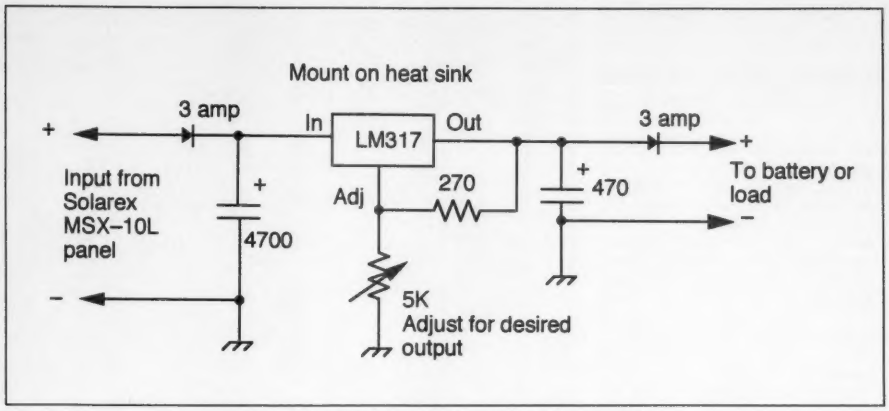

Figure 1. The LM317 in a classic constant voltage regulator.

of a sheet of legal paper, and very lightweight (less than a pound). The MSX-10L is also very hardy. It can take quite a lot of abuse and still generate power. I supplied Bil Paul with his Solarex MSX-10L and he has found it works quite well during a bike trip. There is a hole in each corner so the panel can be held in place with a bungee cord. Of course, the MSX-10L is waterproof! The MSX-10L is $145 from my SunLight Energy Systems company. Send me three stamps and I'll return a short-term catalog.

Batteries are heavy, so you have to have the maximum capacity/weight ratio. In most cases, the common gelled lead-acid battery is the best choice. If your're planning a long trip with an overnight stay in a hotel, then a small AC-powered charger for the battery pack is worth having. You can top off the battery and give it a slight equalization charge, too.

Don't forget about the batteries for the HT, too. If you plan on touring very far, a 2 meter HT is a very good idea. Since most HT batteries are not 12 volts, you have to either have the commercial auto charger plug or a homebrew regulator.

An LM317 adjustable regulator makes this simple to accomplish. You can either set the LM317 as a constant voltage source, or configure it for constant current. The constant current configuration works well with NiCd batteries. In fact, MFJ uses the LM317 as a constant current source in the rechargeable battery pack for their QRP rigs. Figure 1 shows the LM317 in a classic constant voltage regulator. Notice the extra diode on the output of the regulator. This diode prevents the battery from discharging into the regulator at night or when there is not input to the LM317. This circuit does not prevent overcharging of the battery! The diode on the panel side of the LM317 is to prevent damage to the regulator if you connect the panel up backwards to the regulator. A Schottky diode would be the best choice if you have one. If not, then two 1N4001 diodes in parallel will work just about as well. A Schottky diode I've been using in several different circuits is the 3 amp 1N5821.

In either application, you'll need to use a small heat sink on the regulator. The maximum current for the LM317 is 1.5 amps, provided you can keep it cool enough. The MSXP10L will produce 700 mA under full sun.

You can also use this circuit to allow the solar panel to operate a small load directly. If the load is not a battery, you can eliminate the diode and thus gain a little bit more voltage from the LM317. Solar power direct without a battery is a challenge even for a QRPer. Imagine getting DXCC with solar only, no backup!

Adjustment is simple. Connect up the solar panel, or a power supply adjusted to 16 volts, and adjust the trimmer for the voltage required at the output. That's all there is to it. Mount the circuit in a suitable box and you're done. If you plan on using this circuit in the outback, you should seal the entire perf board. I've used hot-melt glue and have had no trouble with it. Or, you might try some liquid casting plastic available from larger hobby stores. Silicon RTV would also work in a pinch.

Next month, I'll have some modifications to several popular QRP transceivers. 73

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Ham Television

Bill Brown WB8ELK
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70 Route 202 North
Peterborough NH 03458

Rocket City ATV

Soon after moving to the Rocket City (Huntsville, Alabama), I decided to check out the local ATV repeater and see what kind of activity I could find. One of the more active ATVers, Dr. John Fox WB2LLB, invited me over to his station to participate in the weekly ATV net.

As I approached John's house, I noticed that he lived in a geodesic dome (designed by his wife Doris). I had a feeling that I would soon be visiting a very unique hamshack!

ATV Studio

Hamshack is not the word for John's operating area. It really should be called an ATV studio (see Photo A). Looking very much like a commercial TV studio, John's spacious hamshack allows him to produce a variety of visual effects with rows of overhead track lighting that he can independently control. On the right in Photo A you'll see his large 33-inch RCA main viewing monitor (reception of the local K4BFT ATV repeater is shown). Above this he has two smaller monitors: one for previewing his special effects and one displaying his transmitted video.

Two camera positions can be selected: one above the viewing monitor, and one located just to the right of the main desk for close-ups. He can select special effects or switch camera views with his Video Toaster program running on the Amiga 2000. In addition, John has another special effects unit (a Panasonic WJ-MX10 A/V mixer) that also includes a time-base corrector). On the wall behind his chair, there are a series of sliding colored backgrounds that allow John to change the visual effect. One panel is a solid blue color and allows him to perform a variety of chroma-key overlay effects. When sitting at his main operating position, he looks just like he's in a TV newsroom!

John became interested in visual communications after working SSTV. He still is active using his Robot 1200C. He is also quite active on the HF bands as well as the OSCAR satellites. His equipment is nestled neatly inside a customized operating console, allowing him convenient access to just about any band or mode, and to a variety of computers.

The Video Wall

In a wing attached to the main dome, John took me to see his video wall in the room next to his hamshack (see Photos B and C). I was presented with a wall full of multi-standard VCRs, TV sets and monitors neatly stacked on shelves. Shortly after becoming active in ATV and SSTV, John thought it would be great to exchange videos with ATVers in other parts of the world. The problem is that there are a wide variety of video standards. After a lot of searching, he found several multi-standards VCRs that could play back and record in PAL and SECAM. Since assembling his international video wall, he regularly exchanges videotapes with ATVers from Australia (John Ingham VK5KG), New Zealand (Mike Sheffield ZL1ABS), France (Gerard Letrou) and a variety of others around the world. John considers his pair of Panasonic AG-W1-P multi-standard VCRs to be the most versatile since they also transcode from one standard to another. He can easily play back an NTSC tape on one machine and record in PAL or SECAM on the other (converting from PAL or SECAM to NTSC is also possible). John has two other multi-standard VCRs without the transcoding capability (National NV-G500EM and a

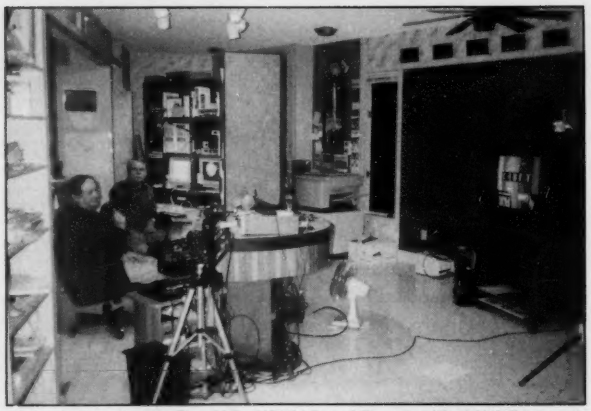

Photo A. (l to r): John Fox, M.D., WB2LLB and Barry Lankford N4MSJ operate from John's ATV studio. The studio offers a variety of special video and lighting effects and has many of the features of a commercial TV installation.

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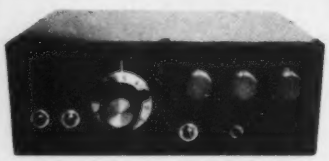

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Photo B. The video viewing room features an 8-foot projection TV screen and a three-gun Chromalux video projector. The videotape scene shows a newscast describing John WB2LLB and Barry N4MSJ (l to r) operating during Hurricane Andrew.

Photo C. John's video wall contains a variety of multi-standard VCRs and TV sets that can view and record in PAL, SECAM and NTSC.

Philips VR6843/56). He also has three multi-standard TV sets and monitors (SONY PVM-1270Q, Grundig P37-342/90 and a SONY KV-2032ME). A couple of regular NTSC VCRs (both VHS and Beta), video disc players and audio equipment fill up the remaining shelves.

As John started to play a tape from Mike ZL1ABS, he said "Let's watch this on the *big* screen." He pulled down an 80-foot diagonal video projection screen and fired up his Chromalux three-gun RGB projection unit hanging from the ceiling in the back of the room. I was truly in video paradise!

Huntsville ATV Activity

Every Tuesday night at 8 p.m., ATVers in the Huntsville area meet on the K4BFT ATV repeater located 1,000 feet above the city on Montesano Mountain (sponsored by the Tennessee Valley ATV group—TVATV). It has an input on 439.25 MHz and output on 421.25 MHz (horizontal polarization). They usually use the 145.33 (-600) repeater for voice coordination during the activity night. The ATV repeater also offers a touch-tone activated Doppler weather feed which is tied in from the local TV19 weather computer. John and I worked some of the more active ATVers during my visit: W4WAD, WA5KRG, W3PM, KK4HF, N4MSJ, KE4ECM and N4GT, to name a few. If you're in the area on a Tuesday evening, give a look for the repeater; at times as many as 20 ATVers check in.

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Surplus Local Oscillator for 2400 MHz OSCAR Satellite, or SSB Operation on 2304 MHz

This month I will continue with the converter aspect of microwave operations and identify a parts bonanza of GaAsFET and bipolar circuitry. Usually, finding GaAsFETs in surplus is rare—that is, other than TVRO devices like LNAs. What I am about to describe is some of the best material from surplus that I have seen, from both the parts and the modification points of view. These surplus PC boards were part of a two-way microwave system for communication and dispatch control of trucks. The business or RF portion that I was interested in is mounted on the roof of a truck cab, looking like a giant white hamburger.

We were fortunate to obtain a quantity of these surplus boards and have made them available for *amateur purposes only*. The PC boards have been removed from their housings to guarantee that the units are broken down from their original configurations. A complete (whole) unit cannot be obtained. Most manufacturers do not want their surplus material resurfacing in the commercial markets to haunt them. Surplus material that is torn apart, reusing some of its components for surplus material, is generally approved for redistribution.

First, a description of the original system. This is a full transceiver for microwave use. The receiver operates on 12 GHz, and the transmitter operates in the 14 GHz range, using a single antenna. A fixed frequency 2.620 GHz synthesizer is connected to a times-5 multiplier, elevating the oscillator to 13.1 GHz, using two GaAsFET stages (MGF-1302). The multiplier board feeds a splitter amplifier board containing a Wilkinson splitter and four stages of amplifiers (MGF-1302 GaAs FETs) at 13.1 GHz. This board supplies local oscillator signal to both the transmitter mixer and receive mixer. The receiver and transmitter have independent IF boards operating at about 1200 MHz. A common power supply board takes +12 volts input and provides switched +10 volts out with a -5 volt bias supply employing a "power good" function. "Power good" means that no positive voltage will output the supply unless the -5 volt bias supply is alive and active. This is a high-quality protection feature for GaAsFET circuitry. GaAsFETs could be destroyed if only positive voltages, or positive before negative bias, were applied. See Photo A for a look at the system's PC boards.

Almost all PC boards use MGF-1302 Mitsubishi GaAsFETs. The exceptions are the IFs, the local oscillator, and the power supply and transmitter. The FETs in the transmitter are MGF-1423s and K25 and K30 FETs. The receiver/transmitter boards can be converted to 10 GHz operation or stripped for an inexpensive source of GaAsFETs for other projects. Check out any recent *ARRL Handbook* for circuits using these FETs. Kent WA5VJB has detailed several amplifiers in many of the *ARRL Handbooks* very well, using the MGF-1402/1302 devices. The GaAsFETs used in the transmitter board are very expensive high-power devices, with the final stage output of 1 watt into the antenna at 14 GHz. Well, I am getting ahead of myself here. That's better left for a future column. So much for the system in general. Back to the synthesizer board and its conversion.

You may be asking, "What can I use an oscillator for at this frequency range?" Well, it can be modified to cover either OSCAR at 2.4 GHz, or 2.304 GHz for weak signal SSB work. Normally, surplus oscillators covering this frequency range are difficult to locate due to low comercial activity. Photo B shows the basic oscillator PLL synthesizer PC board. Photo C is a close-up of just the oscillator circuitry inside the shield compartment on the same PC board.

The unmodified synthesizer board provides a frequency output of 2.620 GHz at +10 dBm. As I said, material for this frequency has been difficult to obtain. Recent upswings in activity with OSCAR satellite operation at 2400 MHz has started a burst of activity. Historically, weak signal work is carried out at 2304 MHz and satellite OSCAR work operates at 2400 MHz. These frequencies offer several possibilities for local oscillator conversion schemes using a 2 meter IF system. The synthesizer is not limited to the 2 GHz band but can be used on other harmonic-related frequencies as well. It might be possible to re-configure the multiplier to multiply by 4 and use the oscillator and multiplier to form a 10 GHz local oscillator. (A 148 MHz IF, LO frequency of 2555 MHz, times 4 = 10220 MHz. An operating frequency of 10368 MHz-148 MHz (IF) = 10220 MHz.) This aspect of the multiplier splitter board will be addressed in next month's column.

Other possible combinations include: 5760 MHz-145 MHz IF = LO of 5615 MHz, or 1/2 that frequency is 2807.5 MHz. (I hesitate to mention that possibility as I have not tried this upper frequency combination out. I only mention it as an experimental choice to try. It's certainly OK as far as the math goes.) Will the DR (dielectric resonator) go up in frequency? I am not sure. In any case, it's a numbers game with the IF frequency and step size (2.5 MHz) as variables.

Let's take a look at the basic synthesizer unit. It uses a Motorola MC-145152 PLL (Phase-Locked Loop) chip and phase locks the oscillator at 2.620 GHz with +10 dBm of power output. The PC board is no bigger than a pack of cigarettes. For operation it requires a +10 VDC input and a 10 MHz reference oscillator as its system clock. Supply those two signals and the PC board functions. The 10 MHz needs to be of high accuracy for an accurate microwave frequency output.

The oscillator is a microwave dielectric resonant oscillator (DR or DRO if you prefer), with two stages of

"You may be asking, 'What can I use an oscillator for at this frequency range?' "

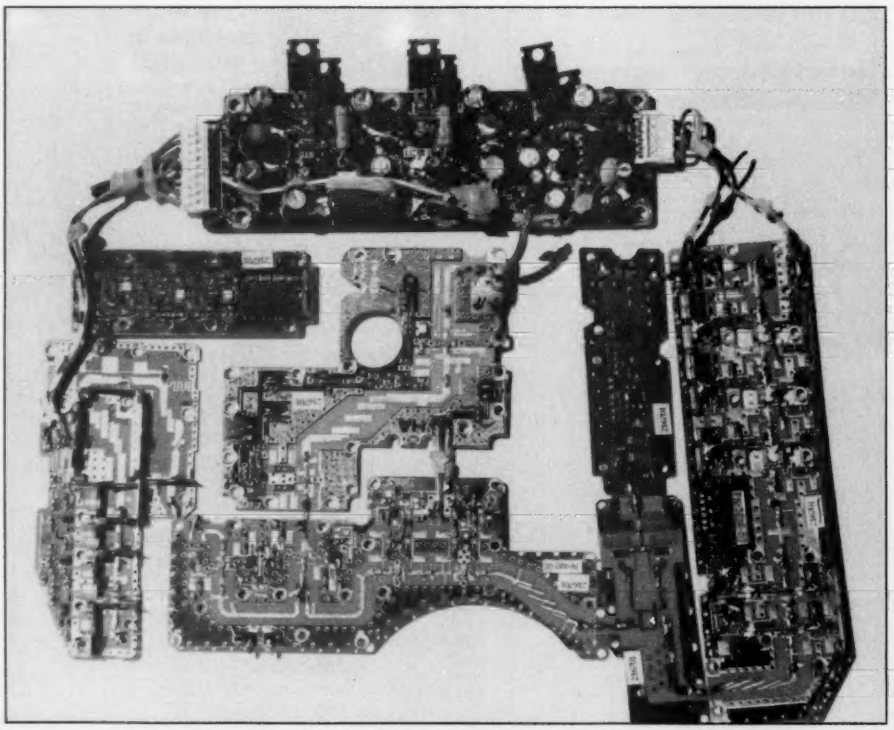


Photo A. Microwave TX-RCV PC boards showing the interconnections between the boards (see text).

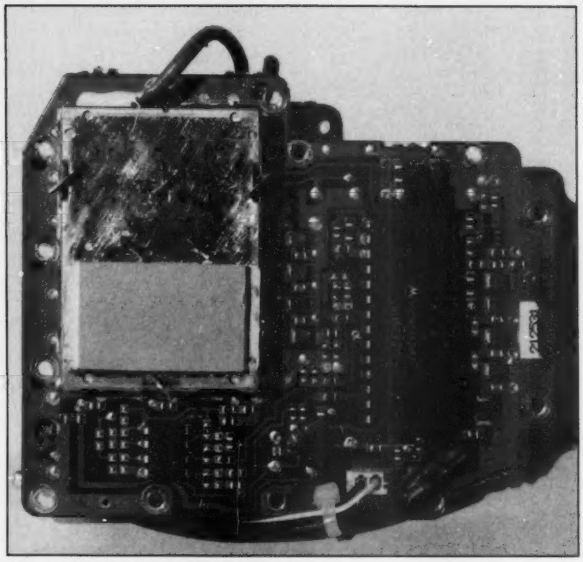


Photo B. 2.620 GHz synthesizer/oscillator. Note the large chip Motorola MC145152 PLL. The metal box contains the DR, oscillator, 2-stage amplifier, and modulus divide by counter chip—a MB510.

1. F IN	2. VSS	3. VDD	4. RA0	5. RA1
6. RA2	7. 0R	8. 0V	9. MOD CTL	10.A5
11. N0	12. N1	13. N2	14. N3	15. N4
16. N5	17. N6	18. N7	19. N8	20. N9
21. A1	22. A2	23. A0	24. A3	25. A4
26. OSC OUT	27. OSC IN	28. LOCK DET		

Note: Pull up resistors internal to chip counter programming pins.

Table 1. Pinouts for the MC-145152 synthesizer chip.

amplification. The synthesizer is unique in that it uses a technique called "Dual Modulus Counting" in both the main synthesizer chip, a Motorola MC-145152, and the divide-by pre-scaler chip, an MB-510, that is an 8-pin chip mounted inside the oscillator shield cover. The MB-510 has a control lead attached to the Motorola PLL chip to control one of two counting (divide) rates. When the "N" counter is active the control line is low, and the chip divides by 256. When the "A" counter is active the control line goes high and changes the division rate to 16. It sounds tricky and it is. However, it is all taken care of on the PC board.

The Motorola MC-145152 chip has three counters that are pin-programmable. They are the reference counter, called the "RA0" counter, and the programmable counters, (Dual Modulus) "N" and "A" counters. All three are internal on the MC-145152 synthesizer chip. Table 1 shows the pinouts for the MC-145152 chip.

Let's examine how to use Tables 1, 2 and 3, as they apply to a stock unmodified oscillator whose frequency is 2.620 GHz. In this case the stock "RA0" counter is set to 8, and all RA0 pins are grounded. The "A" counter is set to 3. The "N" counter is set to 8. The formula looks like this: (1.25 MHz is the existing reference frequency), 2620 MHz = 1.25 MHz X (N X 256) + (A X 16) or, 2620 MHz = 1.25 MHz X {(8 X 256) + (3 X 16)}. The total division number is the frequency divided by the reference frequency, or 2620 MHz / 1.25 MHz = 2096. Pinwise on the MC-145152, its A0 and A1 are open; A2, 3, 4, and 5 are grounded. That equates to pins 21 and 23 being open and pins 22, 24, 25, and pin 10 being grounded, giving the "A" counter a value of "3."

The "N" counter is set to "8." Pinwise on the MC-145152, its N3 is open, and N0, 1, 2, 4, 5, 6, 7, 8, and 9 are all grounded. That equates to pin 14 being open, and pins 11 through 13 and 15 through 20 being all grounded. At all times the "N" counter must be greater that the "A" counter for proper operation.

The "RA0" counter is set to "8" and all three RA inputs are grounded: RA0, 1, 2, or pins 4, 5, and 6 of the MC-145152.

Initial Checkout

Connect 10 volts to the power red wire and a 10 MHz frequency reference oscillator to the black coax cable on the PC board. Microwave output at 2.62 GHz, with a power level of about +10 dBm, should be observed. Make this test to the gray coax cable that is attached to the shield compartment on the board.

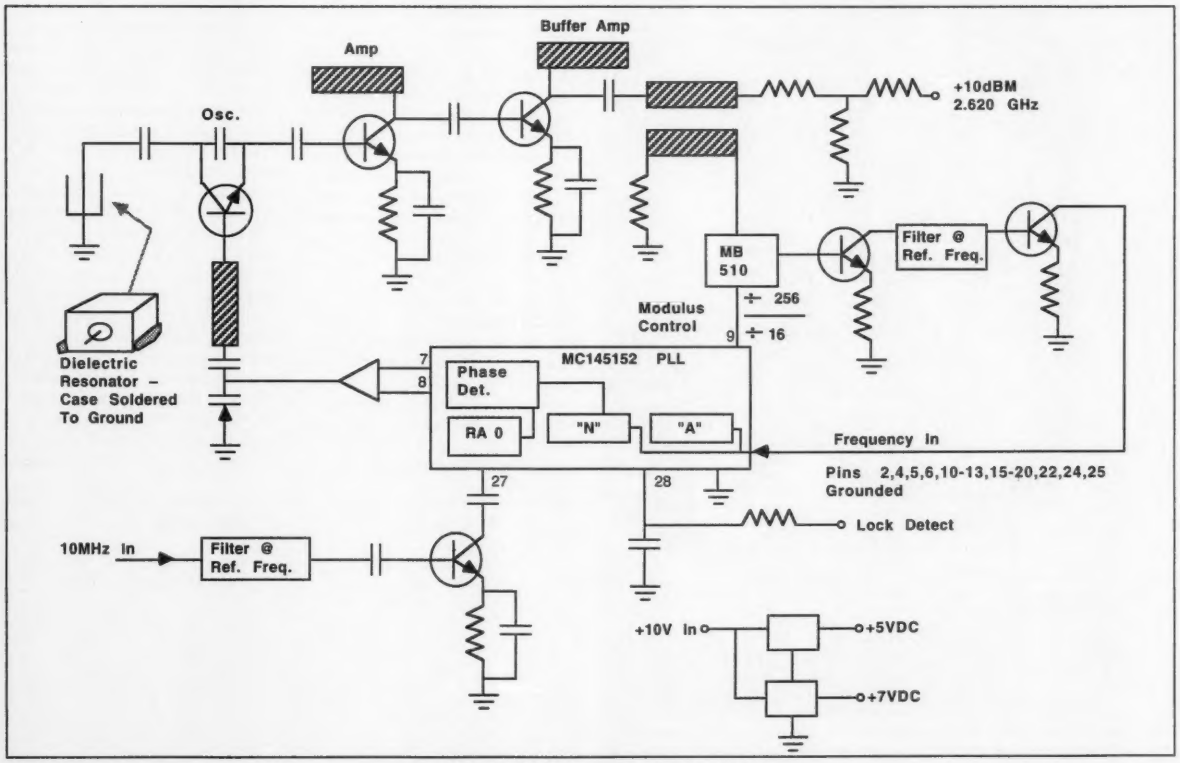


Figure 1. 2.620 GHz PLL synthesizer PC board block.

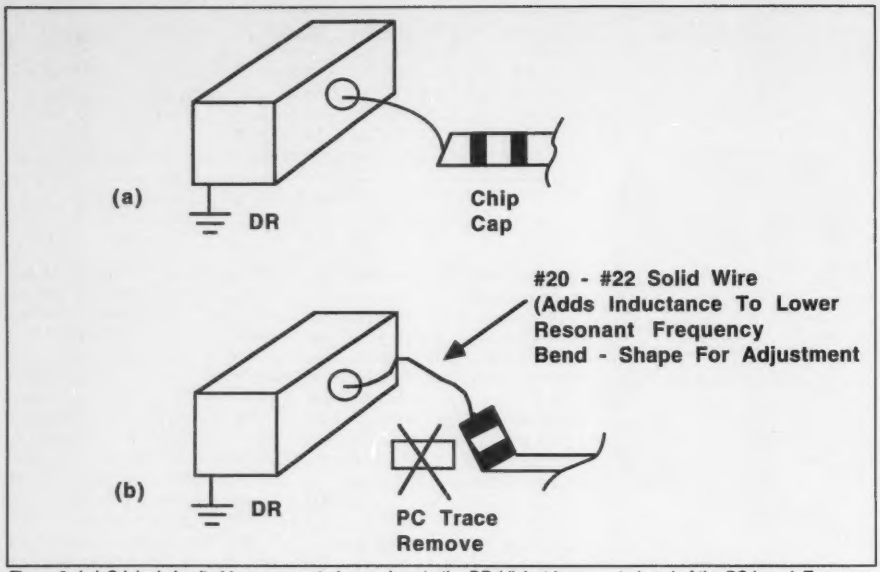


Figure 2. (a.) Original circuit chip cap mounted very close to the DR (dielectric resonator) end of the PC board. Trace connected to the center of the DR. (b.) Modified circuit to resonate at a different frequency. Remove and save chip cap. Remove PC trace near the DR. Re-solder the chip cap and stand on end. Attach a short length of #22 solid wire to the DR to re-resonate the circuit.

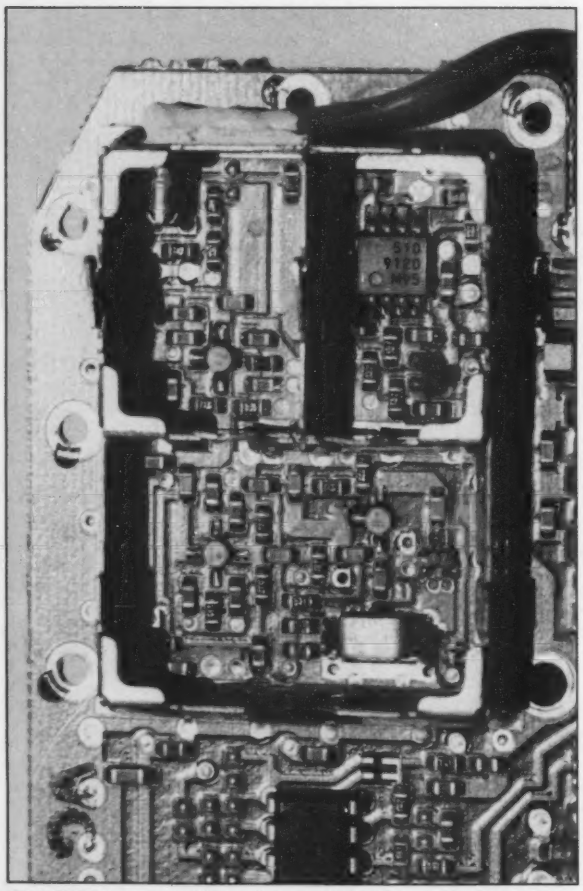


Photo C. Close-up shot of the oscillator and DR (silver rectangle), three transistors, modulus counter (8 pin DIP), inside metal shield compartment. Large 8 pin IC is an OP-27 P/O PLL varactor control circuit.

Modification to Other Frequencies

Modifying these stock synthesizer oscillators to new frequencies makes them very desirable for a variety of different applications. One reprogramming attempt did not function as planned at first, due to gremlins. The frequency desired was 2160 MHz, and the trouble was that the oscillator would not phase-lock, i.e.: *big-time gremlins.* The LO frequency was to be used with a 144 MHz IF for 2304 MHz. Math-wise, the formulation should have worked. Example: Assume LO = 2160 MHz / 1.25 MHz reference frequency equals 1728, division ratio. (1.25 MHz reference when the RA0 counter is set to 8, using the stock board.) The formula is: frequency / reference = (N X 256) + (A X 16), or 1728 = (6 X 256) + (12 X 16).

The math is OK but the Motorola synthesizer chip will not work. According to a note in other *dual modulus counter-applications* data sheets, you should *"never have the 'N' counter-programmed to less than the 'A' counter."* Well, the above formula violates this rule and does not work. Another way to solve this problem is to modify the reference divide-by from 1.25 MHz (8 in the RA0 counter) to divide by (64 in the RA0 Counter). Example: 10 MHz / 64 now = 156.25 kHz, new reference frequency. Then, 2160 MHz / 156.25 kHz = 13824 division ratio, which yields "N" counters higher than the "A" counters for a frequency of 2.160 GHz. Using this scheme, the synthesizer would lock up.

Phase Noise Modification at 156.25 kHz

To clean up the phase noise of the oscillator, the loop filter is set to have maximum loss at the reference frequency. Normally it is set (stock) to 1.25 MHz. When we modify the RA0 counter to divide by 64 we must also modify the locp filter circuit to the op amp *lower* in frequency. The circuitry will function without this loop filter being re-adjusted, but the phase noise will be high. To bring phase noise back lower we need to increase the capacitors in the loop filter by a factor of 8. This change of 8 reflects the same ratio change in frequency (1/8) as the previous frequency (1.25 MHz).

The filter is located on the input of pins 5 and 6 of the op-27 operational amplifier. It is an RC filter and is composed of several 1k resistors and the shunt capacitors; two each 0.001 µF at the bottom of the PC board. There are two 0.01 µF caps in series with two 13k resistors. This is the loop filter that must be modified to supress the phase-noise products.

The Dielectric Resonator

The dielectric resonator (DR), a rectangular silver-plated ceramic-type object located in the oscillator shield compartment must be trimmed to the new desired frequency. It is resonant at 2620 MHz and needs to be slightly modified in order to be resonant at other frequencies. Several different methods can be used to modify this dielectric material, changing its resonance to a new lower frequency. (Without this change the phase-locked loop will not lock up.) If the frequency change is not great, a gimmick capacitor from ground, brought near the center element of the DR, will do the trick. You can test this by placing your finger near the circuit for the same effect. It has been suggested that the DR can be adjusted by applying a measured amount of silicone RTV goop to the DR to accom-

"A" Counter	"N" Counter
A0 = 1	N0 = 1
A1 = 2 may be set	N1 = 2 may be set
A2 = 4 from	N2 = 4 from 3 to 1023
A3 = 8 0 TO 63	N3 = 8
A4 = 16	N4 = 16
A5 = 32	N5 = 32
	N6 = 64
	N7 = 128
	N8 = 256
	N9 = 512

Table 2. "A" and "N" counter-programming values.

RA2	RA1	RA0	÷ by ratio
0	0	0	8
0	0	1	64
0	1	0	128
1	0	0	256
1	0	1	512
1	1	0	1024
1	1	1	2048

Note: 0 = ground; 1 = open (+5V internal pull-up resistor)

Table 3. "RA0" counter reference divide-by ratio.

plish the same trick. I have not yet tried this approach.

If the resonator needs to move by a great span of frequency, such as 2160 MHz, a different approach is needed. In this case, cut the circuit connection from the center element of the DR to the chip capacitor right below the center element of the DR. Bridge this gap with a short section of #20 solid wire bent into a hairpin loop. Solder the hairpin loop from the center of the DR to the chip capacitor. Use a piece of #20 wire about 3/16" long and formed into a hairpin. This inductor is quite critical and requires some fiddling to properly re-resonate the dielectric material to the new frequency.

Another similar method is to cut the trace as above and remove the chip cap and save it. Remove the trace near the resonator that previously connected the DR to one end of the chip cap. Then reattach the chip cap to the remaining far end trace and stand the chip cap on end and solder. Connect the #20 bare wire from the vertical chip cap and reattach it to the DR center element. Adjust the form of the wire to provide enough inductance to re-resonate the DR to your desired frequency. Pete Bauer W6DXJ worked out the above details. It has worked well from 2000 MHz to about 2800 MHz, enabling the PLL to lock up much easier, according to Pete.

Some means will have to be made to compensate for the metal cover plate which will change the adjustment when it is put back into place. All is not lost, but some fiddling will be required to re-compensate the DR and hairpin loop when the cover is replaced on the oscillator compartment.

Well, that's it for this month. Hope you can make use of this oscillator and the newer technology that is starting to show up in surplus. This example is but one of many different types of oscillators that are available today.

Mailbox

Mike K8MB wants to know if it is possible to describe some methods of obtaining the resonant frequency of a stripline compartment such as the K2RIW amplifier before applying power. Mike states that he has been fascinated by these stripline amplifiers for a long time and would like to design one, but he doesn't have the formal training. Mike also has built an amplifier using an 8938 final, and both amplifiers described here are for 432 MHz. Well, one source would be Dick K2RIW, who designed the first amplifier you mentioned. I will give Dick a call and fill you in on the results.

Concerning power amplifiers, I am a poor source for recomendations as I can't coexist in the same room with their blower motors as my hearing is poor. I lost all my high-frequency response due to U.S. Army demolitions work quite some time ago. My hearing range is excellent in the low-frequency range where knuckle-dragging behemoths and blower motors or motorized fans make their noise. Any amplifiers that I build have to be conduction-cooled, and silent! Hence, most of my amplifiers are solid-state or conduction-cooled tubes for silent running in the shack. Concerning technical books, there are several. Almost any edition of the the *ARRL Handbook* does a good job on high power amplifiers. There is another book that was available some time ago from Eimac, the power tube manufacturer, called *The Care and Feeding of Power Amplifier Tubes*. This book might still be available. Check with the Eimac division of Varian, Industrial Tube Division, 301 Industrial Way, San Carlos CA 94070; (415) 592-1221. I don't know current pricing on the Eimac book.

Next month I plan to cover circuitry in the multiplier amplifier, splitter distrubition amps. All the results are not in yet, but it seems promising.

Here is a list of pricing and board availability for those interested: synthesizer PC board $15; oscillator multiplier and amplifier splitter boards $20; 12 GHz rec. $12; 14 GHz 1 watt xmtr $25; power supply $15; or a full set of the above listed PC boards for $75. All prices plus shipping 1st class US Mail $3, 2 lbs., Priority Mail. Requests to Chuck Houghton WB6IGP, 6345 Badger Lake Ave., San Diego CA 92119.

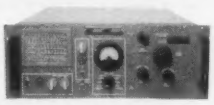
As always, I will be glad to answer questions concerning this and other related subjects. Please send an SASE for a prompt reply. 73 Chuck WB6IGP. 73

Example	Other Possible Solutions	Lo Inj	Op Freq	IF Freq
N = 54,	A = 0 for a LO of 2160 MHz	Loside	2304 MHz	144 MHz
N = 53,	A = 16 for a LO of 2160 MHz	Loside	2304 MHz	144 MHz
N = 52,	A = 32 for a LO of 2160 MHz	Loside	2304 MHz	144 MHz
N = 51,	A = 48 for a LO of 2160 MHz	Loside	2304 MHz	144 MHz
N = 61,	A = 4 for a LO of 2450 MHz	Hiside	2304 MHz	146 MHz
N = 63,	A = 10 for a LO of 2550 MHz	Hiside	2400	MHz 145 MHz

Note: All above examples RA0 counter modified from the original circuit by removing ground (pin 4 of the MC-145152). Reference frequency is now 156.25 kHz. (To find the division ratio, divide the desired frequency by 156.25 kHz. Example: 2160 MHz/156.25 = 13824. Lower divide by referance frequency gives synthesizer step frequency at 2 GHz of a 2.5 MHz step. With 1.25 MHz reference frequency on a stock board, step size is 20 MHz.

Table 4. Other synthesizer programming ratios. Frequencies selected for weak signal frequencies and OSCAR work on 2 GHz.

225-400 MHZ RF AMP



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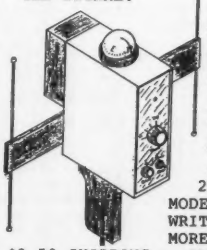

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QRH

When we think of interference, the first thing that usually comes to mind is the possibility of our causing it to others. In today's RF-sensitive world, it's become all too easy to make a mess on a neighbor's VCR, TV, portable phone, you name it. But there's another kind of interference, and that's interference to *us!* Let's face it, ham signals usually aren't nearly as strong as those from commercial broadcast stations, and we need all the RF peace and quiet we can get. On VHF/UHF FM, the problem usually is minimal, because of the noise-rejecting nature of FM. But on HF, and even on VHF SSB, it's another story. There's QRM (man-made interference) and QRN (natural interference) aplenty. So, in the interest of learning to recognize the various kinds of noises, let's take a wander through the wonderful world of interference to hams—what I like to call QRH.

Mother Nature Is A . . .

Noisy lady! Atmospheric noise is a result of all kinds of natural processes, but probably most of it comes from static discharge between charged molecules in the air, caused by simple friction. Typically, QRN sounds like random static. If there's a storm front, of course, it gets really bad, especially on 160 and 80/75 meters. It tends to be quietest in the winter, with summer levels rising dramatically. Why is it worse down on those frequencies? Like any electrical process, the discharges have finite rise and fall times. Consequently, they have an upper frequency limit. Theoretically, there is some energy at frequencies going way up beyond UHF. In practice, though, the amount of energy decreases rapidly as you go up in frequency. So, there's a natural rolloff effect. At 3.5 MHz, there can be enough juice to swing your S-meter up to 40 over 9 or more. But, by the time you get to 14 MHz, QRN rarely goes over S-7 or so. And, above 30 MHz, the effects are pretty small. By the time you get to the 2 meter band, static would be pretty tolerable, even if you were to use AM, like they did in the early days of the band.

Mama Nature makes other sounds besides the familiar static crash, and some people find them interesting enough to actually build receivers just to listen to them! In particular, there's a phenomenon called the VLF whistle. Taking place way down there below 100 kHz, the whistle can sound quite eerie. It's caused by some odd discharge effects associated with lightning, so it generally shows up around storm fronts. Once in a great while you can hear one on the AM broadcast band.

On occasion you can hear other sounds as well. I've heard ticks, pops, squeals, and other assorted, hard-to-describe sounds. If you want to listen for them, try tuning an AM pocket radio to the bottom of the dial, away from any stations, if at all possible. Better yet, if you have a general coverage receiver that goes way down there, try that. Just keep in mind that using an outdoor antenna when a storm's around is foolhardy.

"Just keep in mind that using an outdoor antenna when a storm's around is foolhardy."

Go Away

What if you *don't* want to listen to those noises because you'd rather listen to actual stations? There are ways to greatly reduce the effects of QRN, but they take some doing. I've never found noise blankers to be useful against static crashes on 75 meters. The darned crashes just don't have fast enough rise times to trip the blankers, which are really designed to stop fast-rising, man-made impulse noise. The best way to reduce static crashes is via the antenna. Some people use a noise-sensing antenna, which picks up the static but doesn't hear most of the signal. Once you have a sample of the noise without the desired signal, you can invert it and cancel out the noise in the receiving antenna. It works, but it can be tricky to get it to work well. Another approach is to use a loop antenna, because loops tend to ignore a lot of noise anyway. The worst antenna to use in noisy conditions is an unbalanced one, such as a quarter-wave vertical or an end-fed wire. The difference in noise pickup between a vertical and a loop is nothing short of astounding.

Making Our Own Mess

Unless you're operating on the lower HF bands, QRN probably won't be much of a problem for you. Much more likely, your noise troubles will be man-made. QRM can come from so many sources that I couldn't even begin to cover them all. Let's take a look at some of the more common ones.

That Darned TV

Yup, we can indeed be plagued by reverse TVI. TV sets are among the dirtiest electronic animals on earth. The receivers themselves usually are decently shielded, but the picture tube and its associated scanning and high-voltage circuits tend to have no shielding whatsoever! Almost always, the only thing between you and the yoke coils is the plastic cabinet. And, the scanning currents which sweep the beam across the tube in the required raster pattern are, by necessity, sawtoothed waves. That means harmonics. Many sets put out remarkably strong signals all the way up through

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at least the 20 meter band. The tip-off that an offending signal is coming from a TV is that it repeats about every 16 kHz. 15,735 Hz, to be exact. That ragged-sounding signal comes from the horizontal scanning frequency employed by American-standard (NTSC) TV systems. (TVs in other countries use different horizontal rates, resulting in their signals' repeating at different intervals on the radio dial.) The vertical scan, which occurs at 60 Hz, also can make some noise, but usually the horizontal is the one you'll hear from next door. That's because the horizontal sweep is also used to generate the high voltage required by the picture tube, with very fast rise-time pulses driving a "flyback" high-voltage transformer. So, you've got fast, high-voltage stuff running around like crazy, and noise is inevitable.

Another source of reverse TVI is the color crystal. Color decoding is accomplished through synchronous demodulation. The standard technique is to sync a crystal oscillator's phase to the "burst" phase reference signal riding on the end of each horizontal sync pulse. The oscillator runs at 3.579545 MHz, which is just above the lower edge of the 80 meter CW band. In fact, some hams who are causing TVI to others deliberately listen to that frequency to see if any nearby TVs are on! If they can't hear anything, it's a good bet there's nobody around to bother. Now and then, harmonics of the color oscillator can be heard, but they're usually weak.

With VCRs in every home, a new source of TVI and QRH has mushroomed. VCRs are very complicated beasts, and they have all kinds of frequencies running around in them. Like TVs, they have color oscillators. They also have FM RF generators in the 3 to 6 MHz range, which are used to actually put the signal on tape. Plus, there are servo systems and multiphase motor drivers. Yuck! Unlike TVs, though, most VCRs have metal cases, at least on three sides. Still, they can be noisy, and they do tend to pick up our signals when we least want them to.

If your neighbors are on cable, chances are you're glad, because you have much less chance of causing TVI. But, some cable systems are leaky. In addition to letting your transmitters' signals in, leaky cables let their signals out to disturb you. They show up as noises and carriers on the 2 meter band, because cable systems use those same frequencies. I've never heard of HF noise being caused by cable, though; they don't use frequencies that low.

A Houseful of Gadgets

These days, darned near everything in the house has a microprocessor in it, and all micros use high-frequency pulses to operate. Here comes the noise! But, before you go complaining to the neighbors about their stuff, take a look at your own. Every digital clock you own is potential trouble. Most use pretty low-frequency crystals, in the 100 kHz range. They can have troublesome harmonics, but most clocks operate with such low power that you won't hear them. Some, though, can be a pain. I've got something in my house that generates a strong signal on 14.318 MHz. I know that's a common microprocessor frequency but I still hear it, even with all the computer gear off. But consider this: Any device which keeps time when off must have a clock and, therefore, an oscillator going all the time! I guess the only way I'll ever find that darned thing is to go around with my pocket shortwave, looking for the strongest signal.

But wait, there's more. Many of today's devices use switching power supplies. Just about all computers do. So do fax machines. Sometimes, even innocent-looking little AC adapters actually are miniature switchers! In particular, the ones that come with laptop computers and camcorders will be switchers. The one on my fax machine is noisy as heck. Unfortunately, it likes to yowl on the 20 meter band. Why it couldn't have picked some obscure military frequency, I don't know. The signal sounds a lot like a TV set, with a wavering, coarse noise repeating up the dial. Unlike a TV, though, it drifts, and it also doesn't repeat at the TV rate of 16 kHz.

If you think we've covered all the QRH sources, think again! There are fish-tank heaters, neon and fluorescent lamps, and even central heating/cooling system thermostats. The fluorescent lamp issue can crop up where you least expect it. Many ham radios use fluorescent displays, and the darned things can sometimes get into your receivers! Also, your own rigs' oscillators can get into other rigs! I used to have that problem with a 2 meter rig that sat on top of my HF radio. The HF radio put out a pretty strong local-oscillator signal which I could hear all over the place on 2 meters. As I'd tune the HF rig, the signal would suddenly break the squelch, giving me quite a surprise.

One common source of QRH which has gotten a lot of press in the last few years is the touch lamp. These things use an oscillator which quenches when you touch the metal base of the lamp, tripping a circuit which turns the light on or off. But, that continuously-running oscillator wanders all over the place, and the cheap lamps put out harmonics which can be heard at a tremendous distance. I'll never know for sure, but I suspect that's what I was subjected to back when I lived in an apartment building in Boston. I had such noise I couldn't hear much of anything on HF a lot of the time. Pocket radio in hand, I scoured the building, but every darned piece of metal in it radiated the noise, with seemingly equal strength! I never did find it, but a neighbor three floors down moved out one day, and the noise disappeared.

One final source of noise which bears mention is the electric company. Bad insulators, leaking or arcing transformers and such can create all kinds of RF monsters. And one of the worst offenders of all is the streetlamp. I've heard more noise from those stupid things than from anything else. If your power-line noise goes away after it rains, chances are it's caused by a bad insulator. If it only comes on at night, suspect the streetlamp, especially if there's one really close by. In theory, they will come out and fix these problems pronto, because they don't want all the other issues that go with them. In practice, though, it seems to vary by region; some electric companies really will run out and make repairs, while others couldn't care less.

Well, I hope you've enjoyed this look at QRH. Sometimes, it seems a wonder we hams can coexist with all the RF-producing and sensitive devices under which we're buried. Remarkably, it usually all works fairly well. But, the number of noise makers is only going to increase, and it pays to be able to recognize the likely sources by their characteristics. All's fair in love, war and radio! Until next time, 73 de KB1UM.

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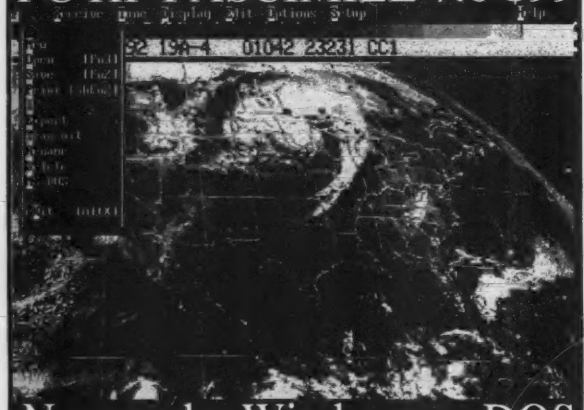

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Arnie Johnson N1BAC
43 Old Homestead Hwy.
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Notes from FN42

The spring blahs have arrived! It's between winter and summer here in New England as I write this (April 3), also known as "mud season." I keep looking out my back window hoping to eventually see white snow replaced by the green of grass.

I also look at the tree limbs lying in the yard, still covered by some snow and ice. Several of these limbs caused my 160 meter dipole to return to earth, along with the limbs. Luckily, the wire didn't break (I use a pulley and counterpoise at one end) and I was able to restore it to almost its original position and condition.

Many other hams are making plans to put up new antennas or reconfigure others. One ham is moving into a new house, so I see an antenna party coming on.

Plans are now in the works for a bigger and better Field Day than last year, and the year before, and the year before that, etc. The fever has taken hold. Now starts the fun part of the year, as long as the weather cooperates. I guess we'll come out of the spring blahs pretty soon, after all.

Thanks to Ted Melinosky K1BV for his information from Romania. Ted is the editor of the K1BV Directory of DX Awards. *I am told by many DXers and award chasers that his directory is the bible for DX Awards. Keep up the good work, Ted. You can get more info from him or send info to him at the following address: HCR 10 Box 837A, Spofford, NH 03462-9740, USA.*

Charles Warrington WA1RZW, 73's Senior/Technical Editor, has written to many of the Caribbean Islands to find out what each island requires for a ham to be able to operate legally. Only two have replied to date: the Commonwealth of Dominica and St. Kitts-Nevis. The responses from both follow in "Roundup."

We at 73 would be very happy to publish the requirements necessary for hams from other countries to operate in your country. Please send your information to Charlie or myself at the 73 address and the abbreviated info will be presented along with the appropriate address and fees (if provided).

That's enough from me. On to the ham news from around this great world of ours.—Arnie N1BAC.

Roundup

Caribbean *Letter from Vincent Bacchus KA2CPA:* The Friendly Caribus Connection is a Caribbean/United States regional Amateur Radio Communication Network established in January 1978, influenced by the need for maintaining contacts between Caribbean-rooted hams and their counterparts and families.

Since its inception, the net has operated daily and has contributed to encourage friendliness, warmth, and helpfulness that characterized the West Indian identity.

The formal net operates on 14.283 MHz every morning between the hours of 1030-1200 UTC on weekdays and 1100-1400 UTC on Sundays. On most afternoons they gather at about 2130 UTC for rag-chewing.

Since 1982, a convention is held every two years. The first was held in St. Vincent and The Grenadines J8; the second in Barbados 8P; the third in Trinidad & Tobago 9Y; the fourth in Dominica J7, where a constitution was ratified; the fifth in St. Lucia J6; and the sixth will be held this year in Grenada J3 from August 8th-13th, 1994.

The Friendly Caribus Connection has now embarked on yet another project, the sponsoring of an award certificate for working the 13 1993 member countries of The Caribbean Community and Common Market, called CARICOM.

The award certificate which is hereby submitted for display would be issued to each ham applying and showing evidence of the qualifying requirements. Send the application and a copy of your log (certified and signed by another ham, NO QSLs), with $5 US to cover postage, to: The Friendly Caribus Connection, c/o Vincent Bacchus KA2CPA, 130-72 227 Street, Laurelton, NY 11413.

The rules are basically to contact each of the member countries on any band or mode, or any combination of bands and modes since January 1994. The countries are: Antigua V2, Bahamas C6, Barbados 8P, Belize V3, Dominica J7, Grenada J3, Guyana 8R, Jamaica 6Y, Monserrat VP2M, St. Kitts/Nevis V4, Lt. Lucia J6, St. Vincent & The Grenadines J8, and Trinidad & Tobago 9Y.

Columbia *Letter from Colonel (Ret) Alvaro Martines-Saltedo HK3AVA, President, Liga Colombiana de Radioaficionados:* Due to the importance of Malpelo and San Andres Islands as DX countries, this letter is to provide some information of the facts that we consider important, related to the recent operation of I2RAO, Ermano Ramaioli, from the Columbian islands of Malpelo, Gorgona and San Andres.

1) The permit extended to Mr. Ramaioli by the Colombian Communication Authorities to operate from these islands, although legal, was irregularly issued, since our law requires the existence of a reciprocity agreement, and there is none signed with Italy.

2) Mr. Ramaioli did not request a permit to disembark in Malpelo, currently under the Naval Administration Service. However, due to a miscommunication, he was allowed on the island for two days. This means that on the other days of his operation he was not actually operating from the island.

We consider that these facts should be known by those who made contacts with I2RAO/HKØ. However, by expressing them, we don't want to imply that Mr. Ramaioli has committed any illegalities. This information has already been sent to the ARRL DX Advisory Committee for their consideration. *Colonel (Ret) Alvaro Martines-Salcedo, President, Liga Colombiana de Radioaficionados, A.A. 584 Y 4259, Santafe de Bogota D.C., Colombia. "Radioaficion y servicio para todo el mundo."*

Commonwealth of Dominica *Letter from Olwyn Norris, DARC:* In order for an amateur radio operator, who is licensed in the United States or any other country, to operate in Dominica, he would have to furnish the Ministry of Communications, Works and Housing with evidence that he is in fact a licensed operator. Normally, a copy of his license is presented. Then, a guest license, duly signed by the Minister, is issued. It is a simple process, the length of which depends on the availability of the Minister.

It should be noted that guest licenses are issued to operators in person and never in advance of their arrival in the country. *[Olwyn Norris, Secretary, Dominica Amateur Radio Club, PO Box 613, Roseau, Commonwealth of Dominica.]*

Republic of Crimea, Ukraine *Letter from Andy Morrison KZ1L:* UU2JQ has informed me that since no QSLs have been received from Box 88 since 1992, a new bureau for the Crimea has been set up.

All cards for the Crimea (callsigns beginning with UU) should go to: QSL Bureau of The Crimean Republic, PO Box 38, Simferopol, 333000, Republic of Crimea, Ukraine.

Rusty adds, "Don't send $, please send only IRCs." *[Andrew Morrison KZ1L, 2 Joan St., Pepperell MA 01463-1322.]*

Romania *Letter from Ted Meli-*

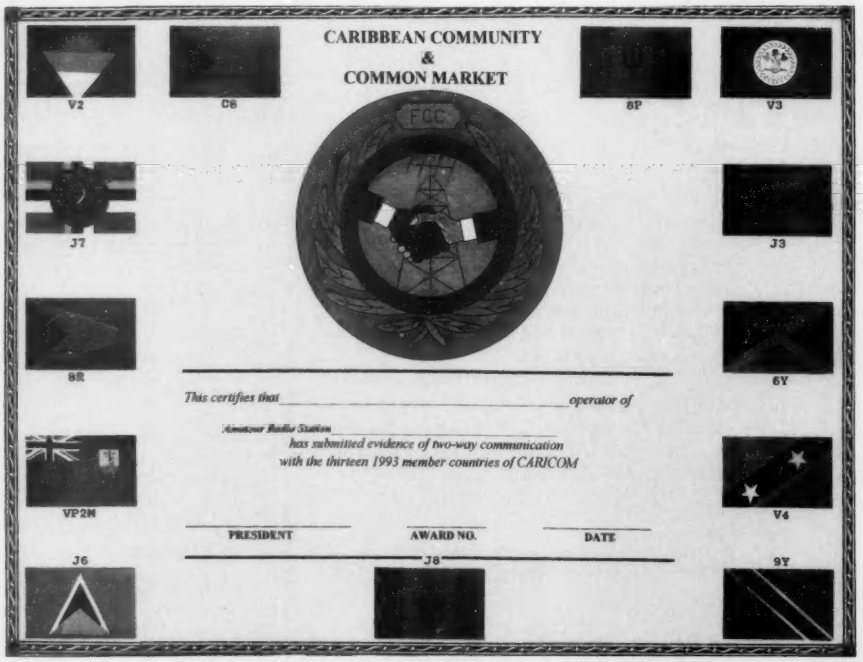

Photo A. Certificate from the Caribbean Community & Common Market.

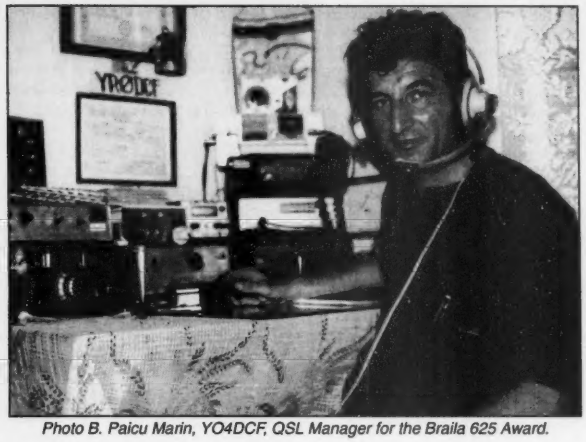

Photo B. Paicu Marin, YO4DCF, QSL Manager for the Braila 625 Award.

nosky K1BV: Paicu Marin YO4DCF activated the special callsign YRØDCF in May 1993 to help his city, Braila, Romania, celebrate the 625th anniversary of its founding. The callsign will continue to be active through May 1994.

The Braila 625 Award is issued for working Braila stations after 1 May 1993. The following requirements are included: Class I Europeans need five contacts, all others four; Class II Europeans four, all others three; Class III Europeans three, others two. Braila DXCC members count for three contacts. Endorsements for any mode or band. SWLs OK on a heard basis. Certified lists of contacts and fee or seven IRCs to: Paicu Marin YO4DCF, PO Box 49, Braila-1, R-6100 Romania. *[Ted Melinosky K1BV, HCR 10 Box 837A, Spofford, NH 03462-9740.]*

St. Kitts-Nevis *Letter from Carl Herbert, St. Kitts-Nevis Amateur Radio Society:* The amateur must complete a form and return it, along with relevant documents to the Telecommunications Officer prior to visiting the country. The license fee is US $25 paid to the Comptroller of Inland Revenue.

The form is too large to reproduce in this column, but the necessary information is: full name, address, age, and occupation of applicant; evidence of nationality (copy of birth certificate, passport, etc.); class of amateur license held (photocopy) and callsign; location of operation; amateur bands, modes, and power to be operated; and a declaration that the information given is true and agree to follow the license terms, provisions, and conditions; signature.

Applications for licenses and renewals thereof shall be made in the month of January in each year and every such license or renewal shall expire on the 31st day of December in the year in which it is taken out.

[I will type a copy of the requirements and put it in Area 12, 73 International, of the 73 BBS, 603-924-9343, 300-2400 bps, 8-N-1. —Amie]

AUSTRALIA

David Horsfall VK2KFU
PO Box 257
Wahroonga NSW 2076
Australia

Quite a lot has happened since I last wrote. The most important news is that the Spectrum Management Agency (SMA, formerly the Department of Transport and Communication) is overhauling the licensing scheme in Australia (for all classes, not just amateurs). At present, there are scores of license categories, each attracting a different fee, and naturally they wish to simplify it. One of the options would have placed amateurs in the same category as CB, a move that is naturally being resisted. The Wireless Institute of Australia (WIA) was approached for its views, and many branches took the opportunity to poll their members. Since there is also a move to adopt a "market-based" system for making use of the spectrum, our bands are under threat more than ever from those with the most money. *[Does this sound familiar to U.S. hams, 220-222 MHz being taken away for commercial purposes?—Amie]*

In light of this, you would think that the WIA would unite against a common foe, but in the case of the NSW Division at least this is not so. It is impossible to fully describe some of the events that have happened recently, but some of the highlights include a packet radio BBS being "dismantled" because of an alleged defamatory message upon it; police being called to arrest broadcast personnel (nothing came of it); police called to Council meetings; broadcast facilities disabled to the extent of removing microphones, fuses, tuned feeders, etc., because of an alleged unauthorized broadcast; various BBSs being ordered to stop forwarding to certain other BBSs; a huge vote of No Confidence in the NSW Council which appears to have been ignored by those to whom it was directed; the list goes on! By the time this appears in print, the NSW Division would have had its Annual General Meeting, at which 18 people were standing for nine positions, so hopefully sanity will return to this part of Australia!

Cheers for now. Those with access to packet or Internet can contact me as "VK2KFU @ VK2AAB.SYD.NSW.AUS.OC" and "dave@esi.COM.AU" respectfully. Note that my packet address has changed, since VK2RWI was one of the casualties in the aforementioned fracas.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel

ISRAELI MUSIC REQUEST FROM SPACE—As our faithful readers are aware, ongoing contacts on 145.550 MHz take place between the cosmonauts of the Russian *Mir* space station and a few hams in Israel, mainly 4X4LF Shlomo on packet, and Mark 4Z4KX, a native-Russian speaker, on voice. When *Mir* is overhead, one may often hear Mark and one of the cosmonauts chatting away.

Followers of Israeli popular music know well the name Ofra Haza, a singer who has made a name for herself, especially in Europe. Nonetheless, Mark 4Z4KX was rather surprised when Cosmonaut Alexander Serebrov RØMIR, on one of his overhead QSOs with him, asked Mark to send a greeting to Ofra. Alexander related that he is a fan of hers and asked Mark to see if he could get a cassette of hers for him.

No problem! As the ham connection goes, 4Z4XC Yair Haza is Ofra's brother, and has promised to procure her latest CD, which will have to be transcribed to cassette, as all they have on board the *Mir* is a cassette machine.

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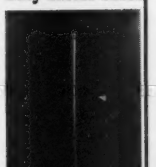

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CIRCLE 118 ON READER SERVICE CARD

NEVER SAY DIE

Continued from page 4

last thing a company needs is a growing bunch of unhappy hams taking advantage of their ability to be heard and passing the word of what's happened to them to warn off prospective customers. Companies soon discover what a small world this hobby really is.

For instance, I know at least one ham who is busy day and night telling anyone who will listen what happened to him when he bought a piece of used equipment and called the manufacturer to get some information. "We don't support that old model anymore. We no longer have any information or repair parts."

And another ham is complaining about buying a piece of equipment, only to discover there were some software problems. He called the company and was told that they'd sent free software updates to those who'd bought his model, but only those with more recent serial numbers. His number was just beyond the cutoff, so he could pay for the upgrade if he wanted, but otherwise, tough. Yes, they knew the equipment didn't work right with the old software. And yes, they'd probably received his registration card, but they don't keep any record of those.

I've watched too many ham manufacturers go out of business through such carelessness. Criminal carelessness. I keep leaning on you readers to talk about something more interesting than the make of your rig and antenna. Well, when a manufacturer screws a ham customer, he's going to talk about that for weeks to come and a lot of other hams are going to hear him . . . and avoid the company like poison.

I'll tell you what. If you have a legitimate gripe about some company in the ham industry and they're ignoring you, just let me know what's happened. I've asked for input like this in the past and gotten piles of mail. The discouraging part of it is that when I looked into the complaints I found that about 80% of them were cases where the complaining hams were at fault, not the companies. No one has ever done the needed research to find out whether crazy people become hams or whether becoming hams makes them crazy. All we know is that the two sure tend to go hand in hand more often than we like to admit. Maybe it's the code that does it. Since Extra Class hams seem, on the average, to be the craziest of us, I've often wondered about that. If you think I'm exaggerating, just ask your wife for a reality check. You're not going to like what she has to say about your ham buddies.

Things You Can Talk About

There really are some things you can talk on the air about other than the weather or a brainless list of your ham gear. All you have to do is read a few magazines and clip out some of the more interesting items. For instance, here are some items I've put into my clipping file just in the last few days.

Time says that new findings suggest that homosexuality seems now to be an inherited propensity passed on most often on the mother's side of the family. I infuriated at least two militant ham gays by opining this in my editorial. There now seems to be an agreement that the Mayas self-destructed via infighting, overpopulation, and the destruction of the rain forests. The main reason the superconducting supercollider was doomed was the cost escalation from $5 billion to $11 billion. At five bil I thought that was a lousy investment.

Thomas Sowell, in a *Forbes* column, pointed out that Hispanics have a lower mortality rate than non-Hispanic whites, even though a great proportion of them are living in poverty and without health insurance. He points out that Americans of Filipino, Chinese, and Japanese ancestry all receive less prenatal care than whites, yet have lower infant mortality rates than whites . . . and that Mormons live 10 years longer than other whites. Hillary isn't going to like that. Have you read Sowell's blistering indictment of our school system in his *Inside American Education—The Decline, The Deception, The Dogmas*?

Also in *Forbes* was a column by Nelson pointing out that zoning is more a matter of politics than planning, and is the foot in the door for government control of more aspects of our lives.

Newsweek cited the failure of busing in ending segregation. After years of expensive court efforts to end segregation in schools, the situation has never been worse.

A *U.S. News* survey showed that 60% of Americans agree that things are deteriorating rapidly in the United States. 80% believe that any additional tax money would just be wasted.

A *Business Week* note says surveys show that good-looking people earn more money. How much are you doing to take the best advantage of what nature (and your folks) gave you for starters? Most people get into rigid habits in their hair styles, makeup, and dress, and these are often far less than optimum. No one has to be fat. I was fat from my teens until 20 years ago. Then I decided to change and I took off 85 pounds, a couple of pounds a week. And I've kept it off. If you read the day-by-day diaries of some of my trips you'll get an idea of how I eat these days.

Did you read the *Business Week* article on the cost of crime? We're spending about $1 million to keep a 25-year-old in prison for life. Incarcerations have tripled just since 1980. "Today, the expected punishment for committing a serious crime is only about 11 days." Our overcrowded prisons have resulted in over 60,000 violent criminals being let out on probation every year. Why are so many youngsters getting into the crime business? It pays off! The average hourly pay from crime ranged from $9.75 to $19 an hour in a Boston survey. Compare that with $5.60 an hour for legitimate work.

There's an endless supply of interesting things you can talk about, and it takes only a minimum of homework to arm yourself with such items. Letterman and Leno are making a career out of commenting on the news, so how about making your contacts more fun? I've a news flash for you: The chap you're talking with could care less what kind of rig you have. He bought his, the same way you did, so what's the big deal? He also doesn't give a snap about what kind of sky wire you've put up . . . unless you've an interesting story connected to it. A very interesting story. Which is highly unlikely.

I don't know about you, but I'd be on the air a lot more than I have been this year if my last hundred contacts hadn't been terminally boring. I honestly don't even care about your lousy weather either. Now give me and the rest of hamdom a break and come up with something to talk about. If you don't, all you're going to get from me will be, "Roger on your handle. Roger on your location. Roger on my signal report. Roger on your rig. Roger on your antenna. Roger on your weather. Over."

Crawling on the Information Superhighway

Yes, CW is digital. So here we are snailing along at 20 words per minute, unchanged from the world of 1894. Fortunately most of us have our blinders on so we don't get panicked by the big trucks whizzing by us at 155 megabits per second. Hey, how many words is that?

Well, let's see. With eight bits per letter, plus a start, stop, and parity bit, and six letters per word on the average, that's 66 bits per word. That comes to 140 million words per minute. That's seven million times the throughput. Well, that's progress, so let's put our blinders back on and pretend it doesn't exist.

Put into that perspective: Our amateur radio communications are still in the technological stone ages, and that obviously includes the code test part of the license exam. We're hanging in there firmly, holding tenaciously to our 1894 technology and doing our best to ignore the real world zipping by all around us.

But if you're going to ignore today's real world, you've really got to stop griping about the unpleasant resulting artifacts . . . such as QRM and pileups. Let's say that your average 20 wpm QSO lasts about 20 minutes. That's about 200 words sent each way, and let's ignore that about half of those are wasted on sending your and his call letters, which presumably you both know once contact has been made. Thus, if you stop crawling along that 1894 forest path and get on the information superhighway over there, your whole contact could be communicated in a little over one millionth of a minute. Say, maybe we should increase the Extra Class exam to 30 wpm.

At a million wpm we could have a thousand times as many hams and still have virtually zero QRM. So here we are, with a few reason-challenged fanatics fussing over CW.

In case you haven't been doing your homework, which I'm sure is the case, that 155 megabit per second figure is what Micro Linear's new cheap Asynchronous Transfer Mode (ATM) chip is providing. See *Business Week*, 2/14/94, page 119. If you turn back to page 115 you can come up to date on MPEG and JPEG data compression protocols. That stuff is whizzing by you on that superhighway over there, oh snail or turtle. Heck, we could be sending each other full-color videos in short bursts and take up less spectrum than we are right now. They're compressing digital video by 95% these days.

Even on voice we're almost a century behind today's communications technology, with our pathetic one-way simplex transmissions. We could easily change to duplex, as I've explained several times recently in my editorials. But we're so solidly locked into our 1890's technology that no power I know of is going to get through.

Heck, back when I got started in amateur radio, in the 1930s, much of our 160m operations were duplex, with one station on the high end of the band and the other on the low end. We even had round tables of six and eight of us all sitting and chatting that way. The FCC inadvertently outlawed this when they made a law prohibiting hams from playing music on the bands. It was unintentional, but it was a disastrous new rule. But then I've noticed that most new FCC rules have unintended bad consequences.

Paving the Superhighway

While we've been squabbling with each other over our little marble game in our federally-protected playground, we've been too busy to notice the heavy construction equipment bearing down on us. Just in the past two years new orders for communications equipment have risen 53%, to an annual rate of $52 billion. Economists see this continuing for the foreseeable future. Pacific Bell and Bell Atlantic both have $15 billion planned for their networks. MCI plans $20 billion. The information superhighway system is expected to require an investment of double what we spent on the interstate highway system in the 1950s in constant dollars.

Well, big deal, right? What has that to do with amateur radio? Some of it has to do with the obvious coming need for more microwave spectrum, and we've a ton of it sitting there unused. But even more of a big deal is the fallout from any battle we might put up to save our microwave and UHF bands. That's when some questions are going to be asked for which we have, so far, no honest answers that make any sense. That's when some people are going to start asking what right we have to these billions and billions of dollars in desperately needed frequencies.

So what are we going to say? The info highway is going to provide an emergency communications system

which will make amateur radio irrelevant. How long do you think it's going to be before telephone systems no longer go out when there is a storm or an earthquake? How long before telephone systems will be able to comfortably handle 10 or even 100 times the normal traffic without failing? Take a good look at the handwriting up there on the wall and stop trying to pretend it is graffiti.

OK, if we're no longer going to be needed for emergencies, then what will be our justification for all those ham bands? At one time amateur radio was a major supplier of engineers, technicians and scientists. In the 1950s the League did a survey and found that 80% of all new hams were youngsters and that 80% of them went on to high-tech careers. Mort Kahn W2KR, who was running the ARRL at the time, put an end to that in 1963 with the so-called "Incentive Licensing" petition to the FCC, which he organized. This disaster put 90% of the school radio clubs out of business within two years, as I've mentioned more than a few times. It also wiped out 85% of the ham dealers and 95% of the ham manufacturers. And with the infrastructure that had been bringing in youngsters destroyed, our growth stopped for several years, and our pioneering of new technologies stopped at the same time. We've contributed almost nothing technologically in the last 30 years. Today amateur radio is so far behind in technology that there is no real hope of our ever catching up.

Another supposed contribution by amateur radio was our providing technically trained youngsters for the military or industry. We aren't doing that either. Today we're mainly a hobby for old, retired, cantankerous, white men. Unfortunately I'm typical. I'm old, semi-retired, white, and no one who reads my editorials will argue about my cantankerousness. As old as I am, I'm still managing to go to ham club meetings to talk where I'm one of the younger ones there.

I'm reading my mail and I'm reading all of the club newsletters we get, so I know that almost to a person, the ham world has its blinders on and is trying to ignore the real world.

Step One

Is the situation hopeless? Well, just about. Frankly, I don't see any ray of hope. Oh, we could save our bacon if we wanted to. We could easily become worth our salt and preserve our bands, but lacking even the slightest hint of leadership from the League, and ditto from QCWA, and ditto again from the Old Old-Timer's Club, there's little pressure to even consider changes. I see the OOTC and the QCWA as primarily devoted to tallying their Silent Keys. Oh, the QCWA under Harry W6ATC started to show some promise of action, but the League lowered the boom and scared the hell out of their executive committee.

Next to Mort Kahn, the old Hudson Division Director, probably the second most destructive influence on the League has, in my estimation, been my biggest (in several ways) champion, Harry Dannals W2HD. I really hate to seem ungrateful to someone who has been such a steadfast Wayne Green supporter, but I have to bow to history.

I do think that sometimes Harry gets carried away with the stories of my WWII submarine exploits, and exaggerates on how I saved *CQ* magazine from disaster in the late 1950s by investing around a quarter million (in today's dollarettes) of my own money in the magazine.

What could we do to make amateur radio worth preserving? If we'd just turn the clock back before the ARRL's "Incentive Licensing" catastrophe, where we had an 11% growth of the hobby per year and 80% of the newcomers were youngsters, we could again be a major supplier of high-tech career youngsters to our country. And this is something our country desperately needs. We need those thousands of school radio clubs back. We need a zillion Elmers. We need to scrap that stupid code test. We need advertising and PR on radio and TV.

They Can't Scuttle Amateur Radio!

Of course not. After all, we have around 500,000 hams (if we include many of the recent dead and a pile of completely inactives) and we have big investments in our equipment, right? Let's say that we have an average of $2,000 tied up in our hamshacks. If you have a calculator handy and check that out, you'll find that the sum total invested for all of us comes to around $1 billion. That may seem like a big number to you and me, but when you're dealing with congress a billion here or there is just rounded off on their calculators. Heck, the government is in debt about $4,500 billion so far, and with no end in sight. How much clout do we think one billion will have in Washington? Heck, we don't even have a lobby . . . and you can bet that all those companies who want our bands do. Companies spending $52 billion have a good deal of money to invest in lobbying.

Maybe we should hold out and get the Regional Bell Operating Companies (RBOCs) to buy our ham equipment from us. It would be one of the cheapest ways they could go to buy some invaluable spectrum.

Of course I'll admit that I'd be disappointed not to continue to talk with all those retired hams who are sitting in their hamshacks with absolutely nothing to say, waiting for their local golf courses to dry up after the rain.

I Don't Always Agree

Put up or shut up. If you don't agree with something I write, then I expect to hear from you, complete with some references proving that you've done your homework better than I have. I don't want any of the usual wishy-washy mealy-mouth nervous-nelly milquetoast emotional crapola about how, well, whine, you don't always agree with me. Stand up and be counted or shut up. 73

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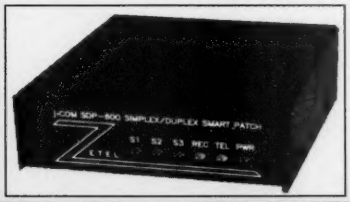

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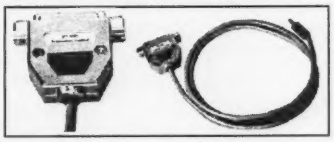

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our* ***BBS (603-924-9343)****. for listings that were too late to get into publication.*

JUNE 4

ALDEN, NY The ATV Group of Western NY will launch a High Altitude Helium Balloon at 9 AM on June 4th (rain date June 5th). Live video may be received on 439.25 MHz, 2 meter CW beacon on 144.34 MHz, and local 40 meter net, starting at 8:30 AM on 7.227 MHz +/- QRM. Overlay on video will display call sign of WA2CXW, along with other info. For details, call *Roger Garbacz WA2CXW, (716) 937-4478.*

KITCHENER, ONT., CANADA The 20th Central Ontario Amateur Radio Fleamarket will be held at Bingeman Park. Contact *Jack Knight VE3RGY, 35 Brockville Ave., Guelph, Ont. Canada N1E 5X5. Tel. (519) 823-1358.*

KNOXVILLE, TN A Hamfest will be held from 8 AM-4 PM at Tennessee Valley Fair Grounds-Chilhowee Pk. Sponsor: RAC of Knoxville. VE Exams. Talk-in on 147.30+ RACK Rptr., and 224.50+. Dealers contact *Angela Crigger N4RPR, 2707 Pine Hill Dr., Knoxville TN 37932. Tel. (615) 694-9071.* For info, contact *Ross A. Ramsey KC4YDR, 790 N. Cedar Bluff, Apt 1111., Knoxville TN 37923. Tel. (615) 690-1520.*

TEANECK, NJ The Bergen ARA will hold its annual Spring Hamfest from 8 AM-2 PM at Fairleigh Dickinson Univ. in Teaneck. Pre-registration required for Flea Market spaces w/power; Contact *Jim Joyce K2ZO, (201) 664-6725.* VE Exams; contact *BARA VE Hotline, (201) 797-0151 before 10 PM.* Talk-in on 146.190/.790; 145.620 simplex.

JUNE 5

EVANSVILLE, IN The Tri-State ARS will hold their 47th Hamfest/Electronic/Computer Show at the Vanderburgh County 4H Center, Boonville-New Harmony Rd, starting at 8 AM (set-up at 7 AM). Talk-in on 147.15/146.79. Contact: *Charlie Apfelstadt N9GWS, TARS, P.O. Box 4521, Evansville IN 47724. Tel. (812) 477-7716.*

MANCHESTER, MI Chelsea ARC, Inc., will hold the 16th annual Chelsea Swap 'N Shop at Chelsea Fairgrounds, beginning at 8 AM. Set-up 6 AM. Talk-in on 146.980/R. For info, send SASE to *P.O. Box 325, Manchester MI 48158;* or call *Gary R. Widmayer, (313) 428-9398.*

NEWINGTON, CT The Newington Amateur Radio League will sponsor an Amateur Radio/Computer Flea Market from 9 AM-1 PM (dealers 8 AM), at Newington H.S. on Willard Ave. ARRL HQ/W1AW Open House. VE Exams by pre-registration only; SASE to *Susan Fredrickson WM1B, P.O. Box 165, Pleasant Valley CT 06063.* Talk-in on 145.45, 146.52 simplex, 224.84 and 443.05. For info, send SASE to *Al Gerke N1JWF, c/o NARL, 63 N Washington Ave., Plainville CT 06062-1921.*

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Talk-in on 146.355/.955. For details, contact *Bruce Burton KU9A, or Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201.*

SALINA, KS The Central Kansas ARC will sponsor its annual Hamfest 8 AM-3 PM, in the 4H Bldg. at Kenwood Park. Flea Market. Commercial Booths. Contact *Larry White KB0BH, 336 Sunset Dr., Salina KS 67401. Tel. (913) 827-3737.*

JUNE 11

ATHENS, GA The Athens RC will sponsor a Hamfest from 9 AM-3 PM at Bishop Pk, Sunset Dr., off US 129. Flea Market. VE Exams at 9 AM. Talk-in on 146.745. Contact *George Kelley WB4VNT, (706) 546-7713* or *Rodney Couch KE4ANM, P.O. Box 6337, Athens GA 30604. Tel. 1-800-959-8273.*

BANGOR, ME A Hamfest will be held from 8 AM-1 PM at Harmon Elementary School. Flea Market. ARRL VE Exams for all classes. CW Contest. More. Sponsored by Pine State ARC. Talk-in on 146.34/.94. Contact *Roger W. Dole KA1TKS, RR#2 Box 730, Bangor ME 04401. Tel. (207) 848-3846.*

GOSHEN, CT A Special Event will be held at Goshen Fairgrounds beginning at 8 AM. Set-up 6:30 AM. Talk-in on 147.285, 146.850. For table space, call *Sid K1SS, (203) 364-0480.* Sponsor: Southern Berkshire ARC.

LOVELAND, CO The Northern Colorado ARC will sponsor "Superfest XVI" at the Larimer County Fairgrounds, 700 S. Railroad, from 8 AM-3 PM. For details on VE Exams, contact *Rick Hubbard WA0DDC, (303) 353-3577.* For table reservations, call *Orlin Jenkins K0OJ, (303) 353-7094.* General Info: *Musser Moore AA0PB, (303) 221-3698.*

NORWICH, CT A Ham Radio Auction will start at 10 AM at Bozrah Moose Lodge on Fitchville Rd. (Set-up at 9 AM.) Bring your gear to sell (10% commission to RASON). Sponsored by Radio Amature Soc. of Norwich. Contact *Rick KD1LC, (203) 376-2216*; or *Tony N1MQS, (203) 859-2041.*

JUNE 11-12

SAN LUIS OBISPO, CA The 1st Filipino-American Ham Radio Grand Eyeball QSO will be held at Lopez Lake Rec. Area. For details, contact *AB6BX,*

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JUNE 12

AKRON, OH The 27th Goodyear ARC Hamfest and Family Picnic will be held at Wingfoot Lake Pk. Flea Market from 8 AM-4 PM (set-up at 7 AM). Please reserve tables in advance. For tickets and info, write w/SASE, or call, *David Hyde W8LFX, 1821 Cromwell Dr. Apt. B, Akron OH 44313-5546; (216) 796-5685.* VE Exams, walk-in only; check-in by 10 AM. Bring original and copy of license, plus photo ID. Talk-in on 146.385/.985 WA8UXP (until 1 PM).

COVINGTON, KY "HAM-O-RAMA 94" will be held by the Northern Kentucky ARC at the Erlanger Kentucky Lions Park. Admission 8 AM. Set-up 6 AM. ARRL, Packet and Antenna forums. Flea Market. Contact *KC4FET c/o NKARC, P.O. Box 1062, Covington KY 41012*; or call *(606) 341-1213.* Talk-in on 147.255+ or 147.375+ Rptrs.

GRANITE CITY, IL The Egyptian Radio Club (W9AIU) will hold its annual EGYPTIANFEST from 6:30 AM-2 PM, at the campus of Belleville Area College, located on Maryville Rd. and Illinois Hwy. 203. The indoor dealer area will open at 8 AM. VE Exams, pre-registration required; contact *Eric Koch NF0Q, (314) 723-0840*; or for Metro St. Louis, call *946-0948* to pre-register. Talk-in on the ERC-W9AIU 146.76 Rptr. Dealers contact *Hamfest Chairman, P.O. Box 562, Granite City IL 62040*; or call *Larry Walton NZ0P, (314) 524-3254.*

HANOVER, PA The Hanover Area Hamming Assn. and the Pleasant Hill Fire Co. will co-sponsor the "Pleasant Hill Computer and Hamfest," at the Pleasant Hill Fire Co. carnival grounds (5 miles south of Hanover). General admission at 8 AM (set-up at 6 AM). VE Exams start at 8 AM; Contact *Bill NZ3J, (717) 359-7090*; or *Pat WW3U, (717) 632-4237.* For info and advance table registration, contact *Ralph Stoffel N3KZS, 5219 Hanover Pike, Manchester MD 21102. Tel. (410) 239-4918.*

OLD WESTBURY, NY An outdoors Hamfest, sponsored by the Long Island Mobile ARC, will be held 9 AM-4 PM at New York Inst. of Tech. Flea Market. VHF tune-up clinic. Talk-in on 146.25/.85. Contact *Neil Hartman WE2V, (516) 462-5549.*

WILLOW SPRINGS, IL An ARRL-sanctioned Hamfest will be held at Santa Fe Pk., 91st and Wolf Rd., starting at 6 AM. This is the 37th annual Hamfest sponsored by the Six Meter Club of Chicago, Inc. Flea Market. Please register in advance. Large Swappers Row. Get advance tickets from *Mike Corbett K9ENZ, 606 South Fenton Ave., Romeoville IL 60441.* Dealers, contact *Joseph Gutwein WA9RIJ, 7109 Blackburn Ave., Downers Grove IL 60516. Tel. (708) 963-4922.* Talk-in on K9ONA at 146.52; or K9ONA/R, 146.37/.97.

WINFIELD/CENTRAL, PA The SVARC and Milton ARC will sponsor a Hamfest at Winfield Fireman's Grounds. Talk-in on 145.18/78 and 146.82/.22. Contact *SVARC, Inc., Box 73, Hummels Wharf PA 17831. Tel. (717) 473-7050. Packet: WY3M @ NR3U.PA.*

JUNE 17-19

RED DEER, ALBERTA, CANADA The Central Alberta Radio League will host their 24th annual Picnic and Hamfest at the Burbank Campsite, approx. 8 km NE of Red Deer. Activities and displays. Talk-in on 147.150+ MHz, or 146.520 simplex. Contact *Bob VE6BLD, Box 1091, Lacombe Alberta, Canada T0C 1S0. Tel: (403) 782-3438. Packet VE6BLD @ VE6RDR.AB.CAN.*

JUNE 18

CORTLAND, NY The 12th annual Cortland International Hamfest will be held from 7 AM-3 PM, at the Cortland County Fairgrounds. Flea Market. VE Exams (reg. 9 AM-10 AM, exams at 10 AM). Talk-in on 147.780/.180. Contact *S.A.R.C., P.O. Box 5241, Cortland NY 13045. Tel. (607) 756-6550 eves. or wknds.*

DES MOINES, IA A Ham/Puter-Fest will be held at Valley H.S. in West Des Moines, by the Des Moines RAA. Doors open 8 AM-2 PM. Flea Market. Set-up at 6 AM. Seminars. Forums. VE Exams at 8 AM (registration 7:30 AM). Contact *DMRAA Ham/Puter-Fest, P.O. Box 88, Des Moines IA 50301*; or call *Mark, (515) 255-6131.*

DUNELLEN, NJ The Raritan Valley RC "94 Hamfest" will be held at Columbia Park (near intersection of Rt 529 and 28). Time: 7 AM-2 PM. Talk-in on 146.625/R, 146.520 simplex. Contact *John Manna WA2F, (908) 722-9045 before 8 PM.*

MIDLAND, MI The 19th annual Hamfest, sponsored by the Midland ARC, will be held at Midland Comm. Center. VE Exams. New and used equipment. Doors open 8 AM-1 PM. Talk-in on 147.00+. Contact *MARC Hamfest, P.O. Box 1049, Midland MI 48641.* Please SASE; or call *(517) 832-3053* eves. and wknds.

JUNE 18-19

SPOKANE, WA A two day Hamfest will be held at Spokane Interstate Fairgrounds, Sat. 9 AM-5 PM; Sun. 9 AM-1:30 PM. Set-up Fri., June 17th. Contact *Ivan Brown, E. 537 Nebraska, Spokane WA 99207. Tel. (509) 489-2667.*

JUNE 19

CAMBRIDGE, MA A Tailgate Electronics/Computer/Amateur Radio Flea Market will be held from 9 AM-2 PM at Albany and Main St. This event will be sponsored by the MIT Radio Soc. and the Harvard Wireless Club. Talk-in on 146.52 and 449.725/444.725 - pl 2A W1XM/R. Mail advance reservations before June 5th to *W1GLS, P.O. Box 82 MIT BR., Cambridge MA 02139. Tel. (617) 253-3776.*

CROWN POINT, IN The Lake County ARC will present their 22nd annual Dad's Day Hamfest at the Lake County Fairgrounds. Doors open at 8 AM (set-up at 6 AM). VE Exams at 9 AM. Talk-in on 147.00+. Contact *Ken Brown KE9TC, 918 Chippewa Dr., Crown Point IN 46307. Tel. (219) 663-5035.*

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FREDERICK, MD The Frederick ARC will hold its Annual Hamfest on Father's Day, at the Walkersville Firemen's Carnival Grounds. Hours: 8 AM-3:30 PM. Talk-in on 147.06/+, 146.52, and 448.425/-. Write to *Frederick Hamfest, P.O. Box 1260, Frederick MD 21702*; or call *(301) 695-2633 - Code #6393.*

MONROE, MI The Monroe County Radio Communications Assn. will hold the "Monroe MI Hamfest" at Monroe County Fairgrounds 8 AM-2 PM. For advance tickets, contact *Tom Cooper N8OSC, 2277 W. Sterns Rd., Temperance MI 48182; (313) 847-6549.* To reserve table or trunk space, contact *Judy Kraatz, 2275 Nadeau Rd., Monroe MI 48161. Tel. (313) 289-2638 eves.* For info, call *Fred Lux WD8ITZ, (313) 243-1053.* Talk-in on 146.72/.12.

JUNE 20

SANTA MARIA, CA The annual Santa Maria Swapfest will be held at the Unocal's Newlove Picnic Grounds, 9 AM-4 PM. Sponsor: Satellite ARC (W6AB). Talk-in on 146.34/.94 WB6IIY/R. For details, call *KD6VLZ or KD6VMA*; or write to *Santa Maria Swapfest, P.O. Box 2067, Orcutt CA 93457-2067.*

JUNE 25-26

ENGLEWOOD, NJ The Englewood ARA will conduct their 35th Field Day Exercise June 25th and 26th, in order to test emergency communications from field locations. The Mayor of the City of Englewood has proclaimed June 19th-June 25th as "Englewood Amateur Radio Assn. Week."

JULY 4

HARRISBURG, PA A Hamfest will be held by the Harrisburg RAC, 8 AM-2 PM (Set-up at 6 AM). Location: Bressler Picnic Grounds. Contact *Steve Gobat KA3PDQ, 1600 Old Trail Rd., Etters PA 17319; (717) 938-6943.*

SPECIAL EVENT STATIONS

MAY 15-JUNE 30

HUDSON, FL Three ships of World War II vintage will participate in the LAST WORLD WAR II CONVOY 1994, to celebrate the 50th Anniversary of the Invasion of Europe: SS Lane Victory, SS John W. Brown, and the SS Jeremiah O'Brien. There will be a Special Events Station on board the SS Lane Victory (W6MWO). These ships will contact the Maritime Mobile Net daily, advising them of the time and frequencies of operation. For QSL cards with ship's photos, send your QSL info with an SASE to *Radio Room, SS Lane Victory, P.O Box 629, San Pedro CA 90733-0529.*

JUNE 4-5

BRANTFORD, ONT., CANADA The Brantford ARC will operate VE32BA, 1400Z-2000Z June 4-5, from the Bell Homestead, to commemorate the 120th Anniversary of Alexander Graham Bell's invention of the telephone (hence the microphone) at the site in the Summer of 1874. Frequencies: 7.170, 14.170 and Club Rptr. 147.150. For a certificate, send QSL and 9"x12" SASE to: *The Brantford ARC, P.O. Box 25036, Brantford ONT, Canada N3T 6K5.*

JUNE 10-11

MT. VERNON, NY The Westchester Emergency Comm. Assn. will sponsor the "American Cancer Soc. Overnight Relay" at 2100Z June 10th-2100Z June 11th, in Dobbs Ferry NY. Station WB2ZII will operate 25 kHz above each Novice frequency. Send QSL's to *WECA Special Event, P.O. Box 831, N. Tarrytown NY 10591-0831.*

JUNE 11

BROOKLYN, NY The Kings County Repeater Assoc. ARC will operate WA2ZWP 1400Z-2000Z to celebrate the Anniversary of Ft. Hamilton Army Base. Frequencies: 28.343, 21.343, 14.343, 7.243, 3.943. For a certificate, send a 9"x12" SASE to *Charlie Quartana N2JZA, 2175 East 8th St., Brooklyn NY 11223.*

JUNE 12

ST. FRANCISVILLE, IL The Radio Amateur Downstate Illinois Organization will operate club Station WD9GTW 1200 UTC-2100 UTC, in conjunction with the Mt. Carmel Airport Appreciation Day. Operation will be on General phone subbands on 15, 20, and 40 meters, 28490 on 10 meters and 146.490 Mt. Carmel Rptr. For a certificate, send SASE with QSL to *MCPA, RR 1 Box 54, St. Francisville IL 62460.* For info, call *(618) 948-2413.*

JUNE 18-19

PONTIAC, MI Oakland County ARS will operate W8TNO from 1200Z June 18th-0200Z June 19th, to celebrate the World Cup Soccer event being held indoors at the Pontiac Silverdome. Operations will be in the lower General phone subbands on 20, 40, and 80, and in the Novice 10m phone subband. For a certificate, send a 9"x12" SASE or IRQ's to *OCARS, P.O. Box 431-244, Pontiac MI 48343-9998.*

VANCOUVER, WA Members of the Clark County ARC will celebrate the 1st annual "VANFEST" (Vancouver Festival), by operating from their homes, using the Club call W7AIA. Operation will be in the General portion of the 75, 40, 20, and 15 meter bands, and in the Novice portion of the 10 meter band. A QSL or certificate will be available for a SASE to *CCARC P.O. Box 1424, Vancouver WA 98668.*

WESTON, WV Station KC8BK will operate 1200Z-2100Z Sat. and Sun., from the Stonewall Jackson Lake Sport and Water Show. This Station will be sponsored by the Central ARA to commemorate the 131st Anniversary of West Virginia becoming the 35th state. Operation will be in the General SSB portion of the 15 to 40 meter bands, and the upper portion of the 10 meter Novice SSB subband. For a certificate, send a QSL and a business size SASE to *C.A.R.A., P.O. Box 1487, Weston WV 26452.*

JULY 3

RUSSIAVILLE, IN The Kokomo ARC will sponsor a Special Events Station honoring the Sesquicentennial celebration of Howard County. Operation will be on 80, 40, and 20 meters in the bottom 25 kHz of the General class bands, and in the 15 and 10 meter Novice class bands. The station will be on the air at 1400 UTC and will continue for 12 hours. Please QSL w/SASE to *Dick Elliot N9IPA, P.O. Box 128, Russiaville IN 46979.*

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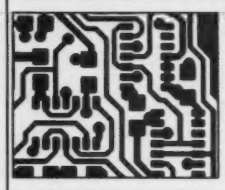

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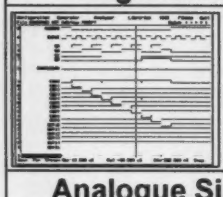

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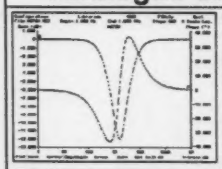

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Continued on page 83

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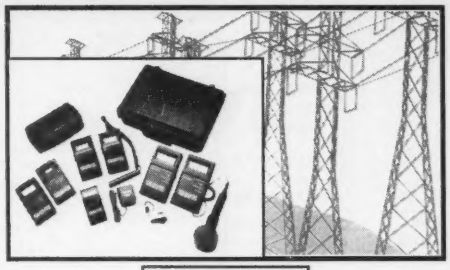

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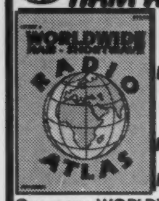

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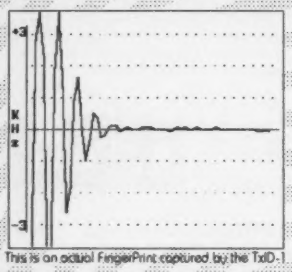

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PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

I think I've made the biggest goof so far this year . . . and I hope you will have received this June issue in time to correct it. In the May forecast, I called for a lunar eclipse on May 25th—but an even more spectacular eclipse will occur on May 10th: an annular eclipse of the *sun*, which will be visible in most of the world except Asia. An annular eclipse means that the eclipse is not total . . . instead, the sun will have a bright ring around a dark center. I didn't even mention that one! So, please excuse the omission. The problem with trying to make corrections when you're working on a three-month-in-advance deadline is that the particular issue in question has already gone to the printers almost *two* months ahead of the cover date. Our publishing staff usually can do the impossible . . . but not the miraculous, so it's *my* turn to be the bad guy this month.

On top of all the foregoing, I can't even offer you a good month for propagation. The first half of the month will be Fair to Poor (F-P), or only Fair (F). The second half looks a little better with conditions Fair (F) or Good (G) and trending between those conditions.

The Poorest days (P) will occur between the 2nd and 5th, and again between the 10th and the 15th. You can expect some *severe* geophysical conditions on the 2nd or 3rd, and again on the 11th or 12th. Remember that the forecast allows a day or two either way from the date given. The rest of the month should be quite normal and provide the usual propagation one can expect at this time of year, allowing for the steady decline in the sunspot numbers. The following are band-by-band conditions:

10 and 12 Meter Bands

Sporadic E will be available during daylight hours on many Good (G) days, with strong skip signals from 500 to 1,500 miles, and you can expect abrupt termination of the contact as the ion cloud passes out of range.

15 and 17 Meter Bands

Good sporadic E contacts between 300 and 1,300 miles on most Good (G) days. You may also find some trans-equatorial skip on Good days into the Southern Hemisphere, with decent signal strengths, but not outstanding.

20 Meter Band

On Good (G) days, consistent DX to most parts of the world during daylight hours, and on particularly good days, often until midnight. *Sporadic E* can be expected out to about 2,000 miles or so on Good and Fair days. Your DX workhorse.

30 and 40 Meter Bands

Nighttime DX will be excellent on Good (G) days and some Fair (F) days . . . but you have to consider thunderstorm QRN that will limit weak station signals which will be down in the noise. Day and night short skip available on Good (G) days. DX is expected often between local sunset and sunrise. Daytime absorption may limit your activities except for short skip out to about 1,000 miles. Nighttime short skip will go out to about 2,000 miles.

80 and 160 Meter Bands

Forget any daytime efforts, but you will find DX on Good (G) days (nights) on both bands, barring QRN from storms when static levels will keep all but the strongest signals un-copyable. Few, if any, DX signals during June on 160, and somewhat slightly more on 80, but don't bet the farm on it. Short skip at night will be pretty good, however, on both bands out to 1,000 miles or so.

Keep your rigs tuned to WWV at 18 minutes after any hour for your up-to-date report of Solar Flux, Boulder A and Boulder K indexes, and the summary of last and next 24-hour periods. See you in July. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
AGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40*	40		15	15	15	10	10
ENGLAND			40*	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40*	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40*	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.						20	20		20			
WESTCOAST	20	40	40	40*	40*	40						20

CENTRAL UNITED STATES TO:

ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40*	40		20			20	
CANAL ZONE	15	20	20	20	40*	40	20	20	15	15	15*	10
ENGLAND	20	40				20	20			20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40*	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40*	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40*	40*		20		15	15
CANAL ZONE	15	15	20	20*	40*	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20*	40*	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20*	40*	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20*	40*	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40*	40*	40						20

1 = Possible 80 meter openings. * = Check next higher band. G = Good, F = Fair, P = Poor.

JUNE 1994

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F	2 F-P	3 P	4 P
5 P-F	6 F	7 F	8 F	9 F	10 F-P	11 P
12 P	13 P	14 P-F	15 F	16 F	17 F	18 F
19 F-G	20 G-F	21 G-F	22 G	23 G	24 G	25 G-F
26 F-G	27 G	28 G	29 G	30 G		

BARTER 'N' BUY

Continued from page 81

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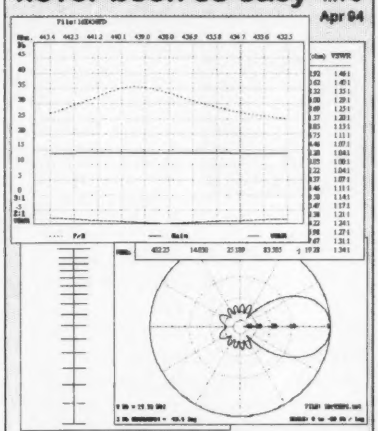

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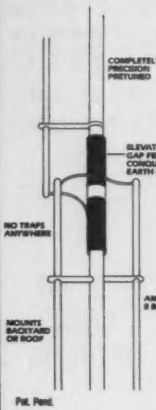

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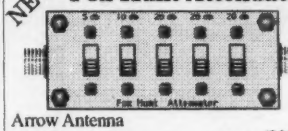

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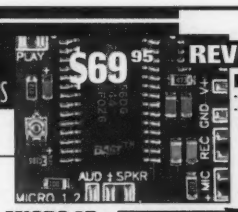

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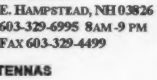

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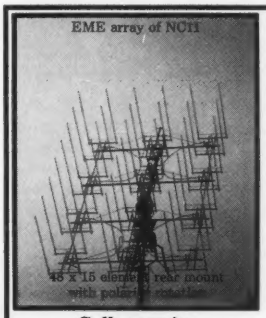

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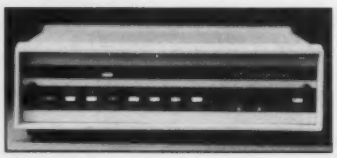
The newest member of the S & S Engineering product line, the ARK4, is the ultimate in a low cost, synthesized amateur radio rig. It's small and portable, easy to build, has top quality components, and it's guaranteed to work. This model is available in several versions, so you buy as little or as much as you need. Kit prices start at only $99.95 for the Synthesized Transmitter, with a full Transceiver (including case) for $199.95. The ARK4 Transceiver, including all options and case, is also available assembled for $269.95.

The ARK4 is one board—no wiring! It tunes in 1 kHz steps synthesized, and finer steps are crystal-controlled. No drift! You can accurately tune the entire 40 meter CW band. Power is 3-4 watts at +12V. The kit contains a MIL quality, glass-epoxy, fully silkscreened PC board and all component parts to assemble whichever version of the ARK4 you desire. All coils and transformers are prewound.

The ARK4 Transmitter is synthesized using a PLL design and has a built-in T/R switch. The Receiver is a superhet single-signal design. The Transceiver features full QSK, sine wave sidetone, and immediate recovery AGC. The fine tune is crystal-controlled and the control has detents so the frequencies are repeatable. The RIT option tunes +600 Hz. The case is steel and extruded aluminum with silkscreened front and rear panels. The Curtis chip keyer is designed right into the PCB. The fully-built complete unit weighs only 25 ounces, including all possible options.

For more information contact *S & S Engineering, 14102 Brown Road, Smithsburg, MD 21783; (301) 416-0661; FAX (301) 416-0963.* Or circle Reader Service No. 202.



KANTRONICS

G-TOR, a new mode for the KAM Plus and KAM Enhancement Board, is now available from Kantronics. This error-free mode can reliably transmit data at more than twice the speed of Pactor under most band conditions. G-TOR operates at 100, 200, or 300 baud, automatically adjusting the speed as necessary, based on band conditions. Huffman compression and run-length encoding contribute to G-TOR's speed. Errors are easily corrected through the combination of Golay forward error correction and full-frame data interleaving. Together in G-TOR, these techniques combine to provide fast, error-free data transmission in a mode that resists interference and reduces multi-path effects.

G-TOR is now standard in the KAM Plus and KAM Enhancement Board at no extra cost and is available as an inexpensive EPROM upgrade for the KAM Plus or KAM with Enhancement Board.

For more information visit your favorite dealer or contact *Kantronics, 1202 E. 23rd Street, Lawrence, KS 66046; (913) 842-7745; TELCO BBS (913) 842-4678; FAX (913) 842-2021.* Or circle Reader Service No. 204.

DAVIS ASSOCIATES, INC.

Davis RF Co. announces the availability of their new "Club Discount Catalog." This new catalog features "Flex—Weave" hybrid aerial wire, DSP audio and noise filters, high-quality coax and wire antenna parts, vertical phasing, baluns, Vibroplex Bencher, B & W, and sundry accessories. The unique aspect of this new club catalog is that it provides amateur radio club members with an easy way to obtain discounts.

All a club member needs to do is have one other club member order with him or her a minimum of $150, or three members on an order need only order a minimum of $100. The "Club Catalog" can be obtained by sending three 29-cent stamps, deductible with order, to the address below. Please specify "Club Catalog." For more information and to order contact *Davis RF Division, Davis Associates, Inc., P.O. Box 230, Carlisle, MA 01741; (800) 328-4773, (508) 371-1356, FAX (508) 369-3484.* Or circle Reader Service No. 205.

DAVIS RF

ICOM

Icom has introduced the new IC-T21A VHF and IC-T41-A UHF handhelds. Packed with innovative new features, these transceivers utilize elastomer construction on the side panels for a grip contoured to fit comfortably in your hand. Combined with a lightweight (11.1 ounce) and compact (2-1/16"W x 4-1/4"H x 1-1/4"D) design, the IC-T21A and IC-T41A are a pleasure to use, even during long hours of operation.

The IC-T21-A transmits and receives on 144-148 MHz; the IC-T41A on 440-450 MHz. Both have dual-band receive capability for full-duplex crossband operation between the 2 meter and 70 centimeter bands.

For further information visit your local Icom dealer or contact *Icom America, Inc., 2380 116th Ave. NE/P.O. Box C-90029, Bellevue, WA 98004; (206) 454-8155.* Or circle Reader Service No. 201.

R.L. DRAKE

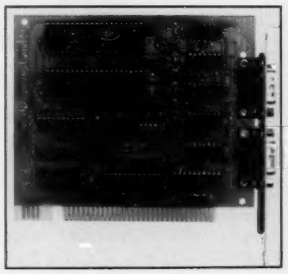
The R.L. Drake Company proudly announces a new addition to their shortwave communications receiver line—the SW8! The SW8 shortwave communications receiver is a microprocessor-controlled, synthesized, world-band communications receiver. A unique and exciting feature of the SW8 is that while it offers the sophistication of a desktop shortwave receiver, it also allows the listener to take quality listening gear wherever he chooses.

The Drake SW8 can be operated either with the supplied AC adapter, or by six "D" cell batteries. It offers continuous-coverage capability from 500 kHz to 30 MHz, which includes the AM broadcast and shortwave bands. Reception modes include AM, AM synchronous, SSB, and FM broadcast band (87-108 MHz). Drake has set the standard for clarity of reception and audio quality.

This receiver is priced at under $600. For more information contact *R.L. Drake Company, P.O. Box 3006, Miamisburg, Ohio 45343; (513) 866-2421, FAX (513) 866-0806.* Or circle Reader Service No. 203.

SEALEVEL SYSTEMS, INC.

Sealevel Systems has introduced a low-cost Windows-compatible RS-232 interface card that will be of interest to HamWindows operators. HamWindows typically requires multiple serial ports for connecting additional peripherals to their computer-based rigs. Most multi-port serial interface boards either do not support the specific hardware requirements of Windows, or they may be extremely expensive. The Sealevel Duocom solves the HamWindows communications challenge by providing a low-cost American-made two-port RS-232 interface.



The unit is designed for PC/XT/ATs and compatibles. It provides the user with two additional Windows/DOS compatible serial ports for modems, printers, terminals, etc., with extended interrupt support.

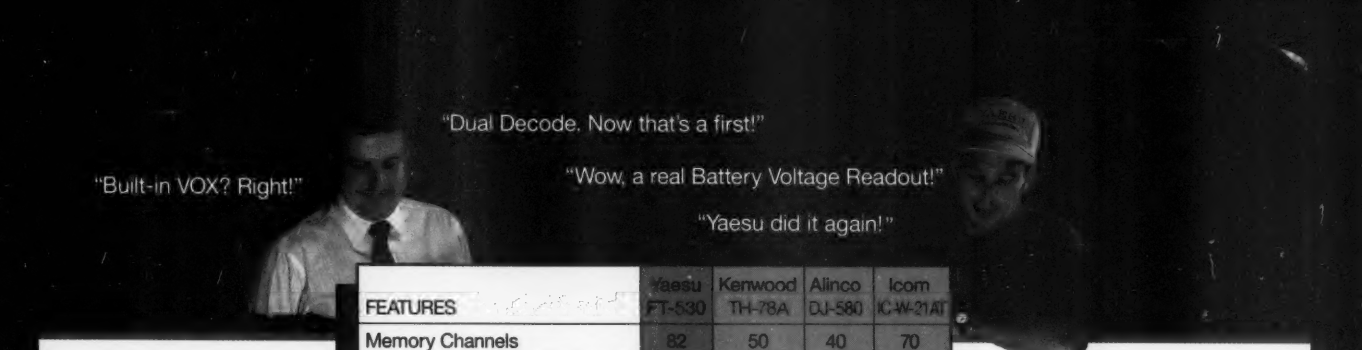
This product offers many features, and is priced at $89. For more information contact *Sealevel Systems technical support, P.O. Box 830, Liberty, SC 29657; (803) 843-4343.* Or circle Reader Service No. 207.

ARROW ANTENNA

Arrow Antenna announces the Fox Hunt Attenuator—a five-step attenuator with 75 dB in 5 dB steps. This RF attenuator box is designed for radio direction finding.

The box is made from double-sided Fiberglas PC board. The five pi-network resistive sections use full-size slide switches with gold contacts. The box measures 4-3/4"L x 1-7/8"W x 1-1/4"D, not counting switches and connectors. The unit is available with either BNC or UHF connectors.

The Fox Hunt Attenuator is available fully assembled for $49 plus shipping ($3 US, $5 Canada). For more information or to order contact *Arrow Antenna, 1461 Peacock Place, Loveland, CO 80537.* Or circle Reader service No. 206.



FEATURES	Yaesu FT-530	Kenwood TH-78A	Alinco DJ-580	Icom IC-W-21AT
Memory Channels	82	50	40	70
Slide-out Lithium Battery	YES	NO	NO	NO
Dual CTCSS Decoder	YES	NO	NO	YES
Battery Voltage Readout	YES	NO	NO	NO
Automatic CTCSS Tone Search	YES	NO	NO	NO
Transmit Battery Saver (Repeater & Simplex Operation)	YES	NO	NO	NO
Built-In Vox	YES	NO	NO	NO
One Touch Reverse Button	YES	NO	NO	NO
Dual In-Band Receive (V+V, U+U)	YES	YES	NO	YES
Programmable External Speaker Audio	YES	NO	NO	YES
Optional Digital Display Mic with "S" Meter	YES	NO	NO	NO
AM Aircraft Receive	YES	YES	YES	YES

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- Built-in cross-band repeat function
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  NC-42 1-Hour Desk Charger
  FNB-25 600 mAh Battery (2 watt)
  FNB-26 1000 mAh Battery (2 watt)
  FNB-27 600 mAh Battery (5 watt)
  FBA-12 6 AA Cell Holder
  CSC-56 Vinyl Case w/ FNB-25
  CSC-58 Vinyl Case w/ FNB-26/27
  E-DC-5B 12 VDC Adaptor
  YH-2 Headset for VOX
  MH-12A2B Speaker Mic
  MH-18A2B Lapel Speaker Mic
  MH-19A2B Mini Earpiece Mic
  MH-29A2B LCD Display Mic with Remote Functions
  MMB-54 Mobile Mounting Hanger

No other dual band handheld beats the FT-530 on features for performance and ease of use. With the largest backlit keypad available, 82 memories, exclusive Dual CTCSS Decode and AM Aircraft Receive, the FT-530 is simply the best value there is.

Compare for yourself, then forget "the rest." See your dealer for the best dual band handheld you can buy. The FT-530.

YAESU

Performance without compromise.℠

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Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.

Kenwood's TM-251A/451A/551A

Shift into Overdrive!

TM-251A/451A/551A

FM MOBILE TRANSCEIVERS

9600

When the going gets rough, Kenwood's mobile FM transceivers show their stuff. For a winning combination of performance and operating ease, nothing beats the TM-251A (144MHz), TM-451A (440MHz), and TM-551A (1200MHz). Despite being single-banders, they have a dual-band receive capability, allowing full-duplex cross-band communications using split-memory channels (TM-251A ↔ TM-451A). Each transceiver is equipped with 41 memory channels (expandable to 200 with the ME-1 option), a digital recording system for messages (max. 16 secs), a dual-menu system, and a 6-pin mini DIN connector for 1200/9600bps packet communications. Built-in DTSS allows 3-digit DTMF selective calling access, and the page function alerts you to incoming calls. There's also a large multi-function LCD with 3 different display modes, as well as a multi-function microphone with 4 programmable keys and 16 DTMF keys. So if you want pole position, choose Kenwood.

TM-451A

Available soon!

TM-551A*

*This device has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.

Features

- Max. 50W output (TM-251A), 35W (TM-451A), 10W (TM-551A)
- 41 memory channels (up to 200 with ME-1 option)
- Dual-menu system ■ DTSS with page ■ S-meter squelch
- Built-in digital recording system
- 6-pin mini DIN connector (1200/9600bps packet)
- Multi-function microphone with DTMF (supplied)
- Fuzzy logic control for tuning
- Selectable frequency step (5, 10, 12.5, 15, 20 or 25kHz)
- Channel number display ■ Auto-lock tuning (TM-551A)
- Band scan, program scan, memory scan, call scan
- Time Operated and Carrier Operated scan stop modes
- Cross-band repeater functions
  TM-251A — TX: 144MHz band, RX: 440MHz band
  TM-451A — TX: 440MHz band, RX: 144MHz band
- Auto repeater offset (TM-251A)
- 10 DTMF memory (15 digits)
- Built-in CTCSS encoder and optional TSU-8 decoder
- 5-step dimmer control
- 3-position RF output power control (TM-251A: 50W, 10W, 5W; TM-451A: 35W, 10W, 5W)
- Auto power-off (OFF, 60, 120, 180 min.) ■ Time-out timer (OFF, 3, 5, 10, 20, 30 min.) ■ Wireless clone function

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